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6.1.7.2 Marine Fish and Fish Habitat

More than 538 species of fish occur in the Canadian Atlantic Ocean (Scott and Scott 1988, Breeze *et al.* 2002). Almost 500 of these species are finfish and the rest are mostly cartilaginous species (Scott and Scott 1988).

Demersal fish are fish that live near the seafloor for the majority of their adult lives; they are commonly referred to as groundfish and have historically supported the largest fisheries in the western Atlantic. Pelagic fish are those species that spend the majority of their lives at the surface or in the water column off the seafloor.

Fish species observed in the Project area are listed in Tables 6.15 and 6.16.

Table 6.15 Fish Species Observed in Strait of Canso - Inhabitants Bay - Chedabucto Bay Area

Common Name	*Scientific Name*	Habitat
Three-spine Stickleback	*Gasterosteus aculeatus*	BP
Four-spine Stickleback	*Apeltes quadracus*	BP
Wolfish	*Anarhichas ssp*	D
Winter flounder	*Pseudopleuronectes americanus*	D
Gaspereau	*Alosa pseudoharengus*	P
Smelt	*Osmerus mordax*	P
Shad	*Alosa sapidissima*	P
Mummichog	*Fundulus heteroclitus*	BP
Rock Gunnel	*Pholis gunnellus*	D
Atlantic Cod	*Gadus morhua*	BP
Atlantic Herring	*Clupea harengus*	P
Atlantic Mackerel	*Scomber scombrus*	P
Cunner	*Tautogolabrus adspersus*	BP
Snake blenny	*Lumpenus lumpretaeformis*	D
Arctic shanny	*Stichaeus punctatus*	D
Smooth flounder	*Liopsetta putnami*	D
Longhorn sculpin	*Myoxocephalus octodecemspinosus*	D
Winter skate	*Raja ocellata*	D
Viviparious blenny	*Zoarces viviparus*	D
Tom cod	*Microgadus tomcod*	D
American Plaice	*Hyppoglossoides platessoides*	D
Pollock	*Pollachius virens*	D
Wrymouth	*Cryptacanthodes maculatus*	D
Salmon	*Salmo salar*	BP
Radiate shanny	*Ulvaria subbifurcata*	P
Capelin	*Mallotus vilossus*	P
Northern Sand Lance	*Ammodytes dubius*	D
Haddock	*Melanogrammus aeglefinus*	D
Hake	*Urophycis ssp*	D
Redfish	*Sebastes fasciatus*	D
Atlantic Halibut	*Hippoglossus hippoglossus*	D
Yellowtail flounder	*Limanda ferruginea*	D
Cusk	*Brosme brosme*	D

P-pelagic; D-demersal; BP-bentho-pelagic

Source: Scott and Scott 1988; Breeze et al. 2002.

Table 6.16 Invertebrate Species Observed in Strait of Canso – Inhabitants Bay – Chedabucto Bay Area		
Common Name	***Scientific Name***	**Habitat**
Lobster	*Homarus americanus*	BP
Sea Scallop	*Placopecten magellanicus*	BP
Snow Crab	*Chionoecetes opilio*	BP
Rock Crab	*Cancer irroratus*	BP
Hermit Crab	*Pagurus bernhardus*	BP
Green Crab	*Carcius maenas*	BP
Pink Shrimp	*Penaeus duorarum*	BP
Northern Shrimp	*Pandulus borealis*	BP
Oysters	*Crassostrea virginica*	BP
Soft shell clams	*Mya arenaria*	BP
Bar clams	*Spisula solidissima*	BP
Blue mussel	*Mytilus edulis*	BP
Horse mussel	*Modiolus modiolus*	BP
BP – bentho-pelagic		
Source: Scott and Scott 1988, Breeze et al. 2002.		

Dermersal Fish

A selection of demersal fish families known to occur in the study area are described below; these families include Flounders, Codfishes, Skates, Sand Lances and Redfishes. These families were selected on the basis of abundance and/or commercial importance in the study area. Information pertaining to habitat and spawning behaviour of common species belonging to each of these families are discussed; fish eggs and larvae are discussed separately.

Codfishes (Family Gadidae)

The Codfishes are a family of medium to large sized demersal fish, which have reached their peak of abundance and diversity in the cool and/or deep waters of the Northern Hemisphere (Scott and Scott, 1988). The codfishes are of great economic importance on the Scotian Shelf, and thus have been studied in more detail than any other demersal fish family in the region. A total of 20 species have been recorded in the area (Scott and Scott, 1988). Of these species, six are of particular interest due to their commercial and ecological importance: Atlantic cod; haddock; pollock; red hake; white hake, silver hake; and cusk (Table 6.17).

Table 6.17 Important Codfishes		
Species	**Habitat**	**Spawning**
Atlantic cod	• From inshore regions to Shelf break • From surface to depths of 457 m • Prefers temperatures between 3-8EC • A variety of habitats	• Spawns from March to December • Spawns in inshore water to depths of 182 m
Haddock	• From inshore regions to Shelf break • Found in water depths of 27-366 m • Prefers temperatures between 1-13EC • A variety of habitats, juveniles have higher survival rates when they settle on sand or gravel bottoms	• High concentrations of spawning activity in March (Browns and Emerald Banks) • Occasional year-round spawning activity • Generally spawns in water less than 91 m
Pollock	• Young are common in shallow inshore waters, while adults live in deeper inshore waters or on offshore banks • Adults prefer a depth range of 110-181 m • Can withstand a wide range of temperatures, from 0-18EC, but prefer a range between 7.2-8.6EC • More pelagic then the other codfishes of the region	• Planktonic egg collections suggest that pollock spawn on the Scotian Shelf in March, September and November • Depth of spawning in Shelf waters unknown, ripe fish were caught in depths of 175-275 m off Cape Breton
Cusk	• Inhabits Shelf and upper Slope • Found at depths of 73-363 m • Prefers water temperatures of between 5-12EC • Usually found over rough or rocky bottoms	• Not well known • Likely spawns from May to August • Thought to spawn in water less then 183 m
Silver hake	• Found from inshore waters to upper Slope waters • Wide range of depths, from shoreline to 910 m • Prefers warmer temperatures then other codfishes in region, from 6-8EC • Found in a variety of habitats, often feeds in water column	• Spawning recorded at a few scattered locales along Shelf edge in March • Spawning concentrations in July (on Sable Island Bank and Western Bank) • Spawns in September and October (over the northern region of the Shelf) • Spawning depths not specified in existing information
Source: Compiled from Breeze et al. 2002; Scott and Scott, 1988.		

Flounders (Family Pleuronectidae)

The flounders are a large family of highly specialized fishes, characterized by a laterally compressed body plan adapted for life on the seafloor. Many species are valued food fishes and support important fisheries. In total, seven species of the flounder family Pleuronectidae are known to occur on the Scotian Shelf and Slope. Of these, five species are of particular interest: the American plaice, the yellowtail flounder, the witch flounder (*Glyptocephalus cynoglossus*), the winter flounder and the Atlantic halibut (Table 6.18).

Table 6.18 Important Flounder Species		
Species	**Habitat**	**Spawning**
Yellowtail flounder	• Found mainly on banks • Inhabits depth primarily of 27-364 m • Prefers temperatures of 3.1-4.8EC • Lives on sand or sand/mud bottoms	• Spawning concentrations in July, but known to spawn throughout the year • Spawns on the Shelf in less then 91 m
Winter flounder	• Most commonly found in inshore waters and, to a lesser degree, on banks • Inshore species, rarely deeper then 40 m • Tolerant of a wide range of temperatures • A variety of habitats, from estuaries to sandy banks	• Spawns in inshore waters
Source: Compiled from Breeze et al. 2002; Scott and Scott, 1988.		

Sand Lances (Family Ammodytidae)

Sand lances are a small family of eel like schooling fishes. Two species occur in the Scotian Shelf region, the American sand lance (*Ammodytes americanus*) and the northern sand lance (*Ammodytes dubius*). However, they are very difficult to distinguish in the field (Breeze *et al.* 2002. p. 152) and there exists some dispute on the validity of the two species being distinct from one another (Scott and Scott, 1988). As such, they will be treated together in this document.

Sand lance are abundant on the Scotian Shelf, with the highest concentrations usually found in depths of 50 m or less. They are not commercially important but play a vital ecological role as forage fish for other marine animals (Scott and Scott, 1988). Sand lance prefer areas of loose sand in which they can burrow to avoid predators, and prefer water temperatures between 1 to 11EC (Breeze *et al.* 2002. p. 152).

Spawning appears to be concentrated near Sable Island and the Middle Banks, given large numbers of larvae caught in these regions (Breeze *et al*. 2002. p. 154). Spawning appears to peak in January and February (Scott and Scott 1988).

Redfishes (Family Scorpaeniudae)

Redfishes belong to the large family of Scorpion fishes. Of the seven species of scorpion fish that are known to occur on the Scotian Shelf and Slope, the redfishes (genus *Sebastes*) are the most common and relevant, both in terms of their economic and ecological importance. The genus *Sebastes* is divided into three very similar species of redfish, two of which, the Acadian redfish (*Sebastes fasciatus*) and the beaked redfish (*Sebastes mentella*), are common on the Scotian Shelf and Slope.

The Acadian redfish is found in deep basins and the Shelf edge, preferring water temperatures between 2.8 to 8.3EC. The beaked redfish is a deeper dwelling species, generally living on the upper and middle slope; there is however, some overlap in range in the Laurentian Channel and on the Eastern Shelf and Slope (DFO 2000). Both species of redfish are abundant and live over a variety of bottom substrates, rising in the water column to feed at night (Scott and Scott, 1988).

Redfish, unlike most other demersal fish, are ovoviviparous; that is the eggs hatch within the female and she gives birth to live young (Scott and Scott, 1988). Young are released on the Scotian Shelf from early spring to July (Breeze *et al.* 2002. p. 161).

Skates (Family Rajidae)

Skates are cartilaginous fishes, belonging to the taxonomic Class Chondrichthyes, and have a characteristic dorso/ventrally compressed body plan with a long, whip-like tail. The Skate Family is a large one, with over 190 species, 15 of which have been recorded from Canadian Waters. In some regions skates are esteemed as food and are important commercial species, however directed fisheries on the Scotian Shelf and Slope are few. A total of five species are caught with some regularity on the Scotian Shelf; these include: the little skate (*Raja erinacea*); the winter skate (*Raja ocellata*); the smooth skate (*Raja senta*); the barndoor skate (*Raja laevis*); and the thorny skate (*Raja radiata)* (Table 6.19).

Table 6.19 Important Skates

Species	Habitat	Spawning
Little skate	• Occurs in inshore areas and over Shelf • Prefers depths of less than 111 m; some have been caught in water as deep as 329 m • Most frequently observed in temperatures between 2-19EC • Found over sand or gravel bottoms	• Reproduction thought to take place throughout the year • Eggs contained within a horny egg case
Winter skate	• Occurs in inshore areas and over Shelf • Prefers depths of less than 111 m • Most frequently observed in temperatures between 2-15EC • Found over sand or gravel bottoms	• Lack of information • Eggs contained within a horny egg case
Smooth skate	• Found on Shelf and upper Slope, often in deep basins • In Nova Scotia recorded at depths of 91-183 m • Prefers temperatures between 3-8EC • Found over soft mud and clay bottoms	• Lack of information • Eggs contained within a horny egg case
Barndoor skate	• Once inhabited a wide variety of habitats, very much reduced from accidental capture • Likely to occur only in areas of little trawling activity (i.e., Slope waters)	• Spawning likely occurs in winter months • Eggs contained within a horny egg case
Thorny skate	• Found in Shelf and upper Slope waters • Prefers depths of 18-996 m • Prefers cool water, between 2-5EC • Found over hard and soft bottoms	• Lack of information • Eggs contained within a horny egg case

Source:
Compiled from Scott and Scott, 1988.

Pelagic Species

Within the pelagic life history classification there exists the epipelagic fishes, which are species that live from coastal to oceanic waters but only within the upper 100 m layer of water. These species are most abundant in the Chedabucto Bay area.

Epipelagic species are usually highly active fishes characterized by fusiform body shapes with countershaded, and often silvery, coloration. Many smaller species, such as herring and mackerel, travel in massive schools, while others are lone wanderers, such as swordfish and billfish. Most species are migratory and are thus present only at certain times of the year. Key pelagic species for the Chedabucto Bay area include Atlantic herring and Atlantic mackerel.

Atlantic Herring

Atlantic herring are a small, abundant schooling species that are important ecologically as a forage species and for commercial value. Herring have a wide distribution across the Shelf, from coastal waters to a depth of 200 m (Whitehead 1985; Scott and Scott 1988). Different herring stocks found on the Scotian Shelf migrate between specific feeding areas and spawning grounds dependent on season (Scott and Scott, 1988). Herring are generally found closer to the bottom in winter, rising to the surface as the water warms in the spring. There is both an inshore and offshore spawning stock of herring on the Scotian Shelf, with most spawning activity occurring in the fall, with some observed in the spring and summer (Power *et.al*). Eggs are deposited on the bottom, where they adhere to gravelly substrate or macroalgaes until time of hatching (Breeze *et al*. 2002). Historical inshore spawning locations were recorded within Chedabucto Bay (Power *et al.* 2002). The Bras D'Or is the closest known location of active spawning (Power *et al* 2002).

Atlantic Mackerel

Mackerel are highly migratory and seasonal visitors to the Scotian Shelf and Slope. Their distribution appears to be determined by their preference for water temperatures in the 9 to 12EC range (Breeze et al. 2002. p. 155.; Scott and Scott, 1988). General migratory patterns show an inshore movement in spring for the summer and fall and an offshore movement to more temperate waters of the Shelf edge in the late fall (Studholme *et al*. 1999). Mackerel are a schooling species that feed on drifting zooplankton, such as amphipods, copepods and fish eggs by filtering them from the water with their gill rakers, and actively hunt small pelagic fish, crustaceans and mollusks (Scott and Scott, 1988). Mackerel feed most actively at night near the surface and retreat to deeper waters during the day. Spawning mackerel are grouped into two broad geographic groups, one in the Gulf of St. Lawrence and the other along the Eastern Seaboard from Cape Cod to Cape Hatteras (Breeze *et al*. 2002. p. 156). However, some spawning occurs along the outer coast of Nova Scotia and on the Scotian Shelf, evidenced by mackerel larvae and eggs caught during exploratory surveys in the area (Bernier and Levesque 2000; Fortier and Villeneuve 1996). Mackerel spawn in the summer months and the eggs are pelagic until hatching (Scott and Scott, 1988).

Species at Risk

A total of seven fish species that occur over the Scotian Shelf are considered to be threatened with extinction and/or extirpation by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2003): Atlantic whitefish (*Coregonus huntsmoni*); Atlantic salmon; Atlantic wolffish, northern wolffish (*Anarbichas minor*); spotted wolffish; (*Anarhichas dentialatus*); Atlantic cod; and cusk. The Atlantic Whitefish is listed as endangered (COSEWIC 2003).

The Atlantic whitefish is an anadromous fish species occurring in only a few river systems in southwestern Nova Scotia (Scott and Scott, 1988). Its movements at sea are poorly known; it is believed to stay in the general vicinity of river estuaries, and is unlikely to occur within the study area (Scott and Scott, 1988).

Atlantic salmon that spawn in rivers bordering the Bay of Fundy are listed as endangered (COSEWIC 2003). Atlantic salmon are threatened by habitat destruction, illegal fishing and possibly other, as of yet unknown, anthropogenic sources. The northern wolffish and the spotted wolffish are listed as threatened (COSEWIC 2003).

Spotted wolffish is a demersal species which prefers water depths 100 to 400 m but can be found in depths ranging from 25 to 600 m. This species is most likely to occur along the northern Shelf edge and upper Slope. The spotted wolffish, like all wolfish, has powerful crushing jaws and feeds on a variety of echinoderms, crustaceans, molluscs and fish.

Northern wolffish is a demersal species that inhabits offshore waters and prefers water depths from 60 to 900 m, and is most likely to be found along the Shelf edge and upper slope. Northern wolffish feed on small fish, echinoderms, crustaceans and mollusks. The distribution of both species (spotted and northern) in the study area is patchy and poorly known (COSEWIC 2003). Wolffishes are susceptible to being caught accidentally in bottom trawls and other fishing gear given their large size and bottom habitat.

The Atlantic Wolffish is a demersal species which prefers cold deep waters of the Continental Shelf (COSEWIC 2003). The Atlantic Wolffish is considered a species of special concern due to accidental capture and bottom trawling.

Atlantic Cod is listed as being a “species of special concern” (COSEWIC 2003). Atlantic cod is a demersal species, preferring water depths from 1 to 600 m. They are widely distributed from the shoreline to the Scotian Slope and feed mainly on benthic invertebrates and fish. Atlantic cod are threatened by overfishing on the Scotian Shelf.

Cusk was recently listed as threatened (COSEWIC 2003). Cusk inhabit the Scotian Shelf in areas of rough or rocky bottoms at moderate depths, 128 to 144 m, and prefers relatively warm temperatures (Scott and Scott, 1988). Cusk is threatened by overfishing on the Scotian Shelf.

The International Union for Conservation of Nature and Natural Resources (IUCN) also evaluates the conservation status of many species. Four other fish species known to occur on the Scotian Slope and Shelf, have been listed as vulnerable (Froese and Pauly 2002): Atlantic halibut, yellowtail flounder, barndoor skate, and haddock.

Atlantic halibut is a demersal species and occurs from Greenland to the Gulf of Maine. This species is an active predator and feeds on invertebrates and other fish. Juvenile Atlantic halibut prefer depths ranging from 37 to 55 m and adults prefer deeper water of 165 to 229 m (Scott and Scott 1988). Halibut are valuable food fish and are threatened by overfishing on the Scotian Shelf and Slope. Halibut, like haddock, are highly esteemed table fish and are threatened by overfishing on the Scotian Shelf.

Yellowtail flounder, another demersal species, occurs at depths of 27 to 364 m and feeds primarily on small invertebrates (Scott and Scott 1988). They too are threatened by overfishing.

Barndoor skates are demersal and feed on lobsters, crabs, shrimp, isopods, crustaceans, bivalves, gastropods, squids, worms and fish. They are the largest skate species native to the Scotian Shelf and Slope and are known to be slow growing and long-lived. They have very few predators due to their large size, but are often captured in commercial trawl nets (Scott and Scott 1988). This propensity for being captured in fishing gear has threatened the barndoor skate; they likely now exist, in any numbers, only in deeper Slope waters not as frequently fished as the Shelf.

Haddock is a demersal species of the cod family occurring from Greenland to Cape Hatteras. This species feeds on small invertebrates and inhabits waters ranging from 26 to 366 m, preferring temperatures of 1°C to 13°C. Haddock occupy a variety of habitats. Spawning activity, which generally occurs at depths of less than 91 m, is concentrated on the Browns and Emerald Banks and usually takes place in March although occasional year round spawning does occur.

Fish Eggs and Larvae

Studies into the distribution of fish eggs and larvae on the Scotian Shelf have focussed largely on species of commercial importance. O'Boyle *et al.* (1984) analyzed the Scotian Shelf Ichthyoplankton Program (SSIP) data and observed that eggs and larvae of cod, haddock, pollock, and silver hake were mostly concentrated on the shallow outer banks of the Shelf (Browns, Western, Emerald, Sable Island and Banquereau). O'Boyle *et al.* (1984) also noted that fish larvae appeared to be retained on the central and southwestern banks, in particular Sable Island Bank, Western Bank and Browns Bank; this could be due to gyres that exist on those banks.

Shackell and Frank (2000) re-examined the SSIP database to determine areas of high fish larvae diversity and abundance. They observed that the Sable Island Bank and Western Bank areas have the highest overall fish larvae diversity and abundance. It may be concluded from these studies that fish eggs and larvae are widely distributed over the Scotian Shelf, that concentrations of eggs and larvae vary with season and location, and that diversity also varies with time and space. Monthly distribution of larvae of key species on the Scotian Shelf, from SSIP data (1978-1982), is summarized in Table 6.20. Comparatively little information exists on the temporal and spatial distribution of fish eggs and larvae in inshore waters (Chedabucto Bay), as most studies have focussed on the Shelf itself and the upper Slope.

Table 6.20 Monthly Distribution of Fish Larvae by Species on the Scotian Shelf, From the Scotian Shelf Ichthyoplankton Program (SSIP), 1978-1982

Species	J	F	M	A	M	J	J	A	S	O	N	D
Herring												
Cod												
Haddock												
Pollock												
Silver hake												
White hake												
Sand lance												
Mackerel												
Redfish												
Cusk*												
Yellowtail												
N. shrimp												
Lobster												
Crabs												
Scallop												

Represents times of peak larval density

Represents larval presence

* Cusk larvae were rare to absent

Adapted from Breeze *et al.* 2002

Plankton

Bacterioplankton, phytoplankton, zooplankton, ichthyoplankton (fish larvae and eggs) and the diverse bacterial and protozoan assemblages associated with marine snow are ubiquitous in all of the world's oceans. Concentration and diversity vary markedly over both temporal and spatial scales as a consequence of a variety of physical, chemical and biological factors.

The nearshore areas of Chedabucto Bay and the Strait of Canso are predominantly rocky sand influenced by the Atlantic Ocean which favours the development of a typical rocky coastline community (plants and animals) found throughout the Atlantic shore of Nova Scotia (Moore *et al.* 1986). Zooplankton and phytoplankton are also typical of coastal waters in the region. Zooplankton and phytoplankton of the Strait of Canso have seldom been studied although they are expected to be similar to those in adjacent waters of the Atlantic Ocean (Stewart and White 2001). Table 6.21 lists plankton species observed in the Chedabucto Bay area.

Table 6.21 Plankton Observed in Strait of Canso – Inhabitants Bay – Chedabucto Bay Area		
Temora longicornis	Echinoderm larvae	*Pseudocalanus elongatus*
Temora longicaudata	Trematod larvae	*Centropages* ssp.
Calanus finmarchicus	Polychaete larvae	*Tortans discaudatus*
Planktonic Foraminifera	Polyzoan larvae	*Oithona plumifera*
Radiolaria	Tunicate larvae	Harpacticoid copepod
Tintinnid	Pelagic amphipod	Decapod Larvae
Source: Stewart and White 2001		

Phytoplankton

Phytoplankton are the microscopic plants that photosynthesize and are the source of food for zooplankton and larval stages of many marine invertebrates and fish (Sameoto *et al*. 1997). These processes, primary production and secondary consumption, either directly or indirectly sustain invertebrate and fish populations.

Some of the key factors that interact to control and modify plankton abundance and diversity include sunlight intensity and duration, temperature, storm mixing (intensity and frequency), periodic intrusion of warm core rings (Gulfstream water), nutrient supply, spawning cycles, and predation.

Peak concentrations of phytoplankton usually occur in spring in response to lengthening daylight hours, reductions in the intensity and frequency of storm mixing, high nutrient concentrations, and low number of zooplankton predators. The development of the spring phytoplankton bloom in March to April facilitates rapid growth and reproduction of many zooplankton species, and this in turn often leads to the collapse of the bloom. In reality, the spring bloom is often a series of blooms of primarily diatom species that form and collapse in response to storm mixing events (and grazing pressure towards the end of the bloom). The spring bloom also serves as a cue, or trigger, for the initiation of egg development and eventual spawning of many benthic invertebrate species and some pelagic and demersal fish. A secondary phytoplankton bloom usually occurs in the fall (September to October) in response to increased storm activity and enhanced nutrient supply from deep waters. This fall cue also leads to increased abundance and diversity of many zooplankton and the onset of spawning activities by zooplankton, benthic invertebrates and fish.

Zooplankton

Copepods are the most abundant zooplankton on the Scotian Shelf and Slope (Breeze *et al*. 2002). Euphausiids, or krill, are also important zooplankton; they are often the principal food source for many fish and whales. However, krill (*Meganyctiphanes norvegica)* prefers depths below 200 m and frequents the edge of the Scotian Shelf (Sameoto and Cochrane 1996). Information on the distribution of plankton, particularly zooplankton, is limited for Chedebucto Bay and the Strait of Canso.

Ichthyoplankton

Recent reviews of historical plankton data indicate that the abundance of ichthyoplankton is not always closely tied to the 'regular' cycles of phytoplankton and zooplankton (Shackell and Frank 2000; Breeze *et al*. 2002). On the Scotian Shelf, greatest abundance occurs from March to June and is lowest during the winter months, December to February. Individual species also appear to have multiple, or at least protracted spawning periods (possibly indicating variable contributions from different fish stocks). All of these conclusions are based on a reanalysis of the detailed Scotian Shelf Ichthyoplankton Program (SSIP) that was conducted between 1978 and 1982 (Shackell and Frank 2000).

More recent studies indicate considerable changes in ichythoplankton abundance and diversity (Breeze *et al*. 2002). These changes probably reflect the combined effects of over-harvesting and long-term variability in atmosphere-ocean climate that influence current patterns, freshwater input, storm frequency and intensity, and nutrient exchange between surface and deep waters.

6.1.7.3 Marine Mammals

Coastal and offshore regions of Nova Scotia attract a wide variety of marine mammal species throughout the year. There are twenty-one species of cetaceans (dolphins, porpoises, and whales) and six species of pinnipeds (seals) which have been recorded from the waters around Nova Scotia (NSMNH 1997); however, many of these species are only occasional visitors to the area. Data available for this analysis are only anecdotal; data from the Observer Program (the Sea Food Producers Association of Nova Scotia (SPANS) Oil and Gas Observer Program Ltd. (OGOP)) and Canadian Coast Guard vessels are outside the Project area (S. Smith pers. comm., 2003).

Marine mammals are important components of North Atlantic coastal and pelagic ecosystems as they are at or near the top of the marine food chain. Due to past whaling activities and low reproductive rates, many of the larger cetaceans are considered globally endangered or vulnerable. In the past, marine mammals have been the target of commercial hunts in the region; several industrial whaling stations were operational in Nova Scotia up until the 1970s. Although commercial whaling has largely ceased, cetaceans are still threatened by habitat destruction, accidental ship strikes, entanglement in fishing gear, and the impacts of chemical and noise pollution in their marine habitats. Nova Scotian seal populations are healthy and not considered threatened or vulnerable at the present time.

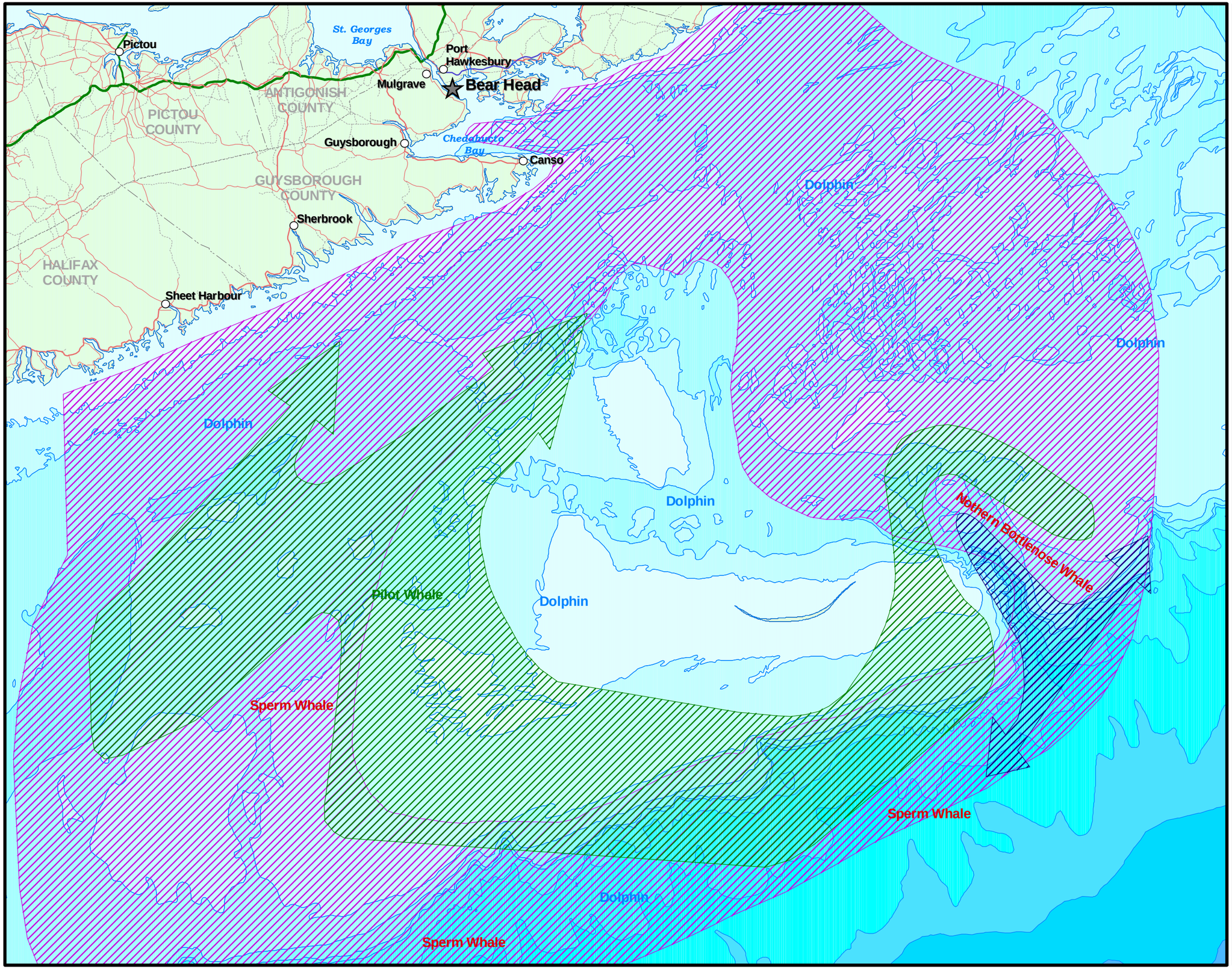
Marine mammals are now sought out by eco-tourists on whale watching cruises; these have grown increasingly popular in the last decade and are now a vital source of income in fishing communities throughout Nova Scotia. There are currently no whale watching tours operating in the immediate Project area. Interest in marine mammals extends beyond their ecological and economic importance, as they have become a symbol for ocean conservation and their protection is of concern to the scientific community and the general public.

Cetaceans

The order cetacea is composed of the dolphins, porpoises, and whales. Within this order there exists two subgroups, the mysticeti whales, known as "baleen whales", and the odontoceti, known as toothed whales. Baleen whales use specialized keratin plates to sieve prey items from the water column or bottom sediments, whereas toothed whales have teeth for actively hunting and grasping individual prey items. Many of the species recorded from Nova Scotian waters are offshore species and are very unlikely to be found within the coastal study area. The following sections give brief descriptions of cetaceans that could occur in the study region at some time of the year. This list has been compiled by contacting DFO staff familiar with the area (D. Sinclair, pers. comm., 2003; S. Smith, pers. comm., 2003; J. Conway, pers. comm., 2003) and from general distribution trends (Figure 6.8), as little documentation exists in the literature on cetacean occurrences in the Strait of Canso and Approaches. Local biologists have reported that unidentified whales are known to enter the Strait of Canso in pursuit of dense schools of mackerel that are known to occur in the area from May to October (J. Reid, pers. comm., 2003).

The harbour porpoise (*Phocoena phocoena*) is a coastal species that has a wide distribution in cool waters of the North Atlantic. Harbour porpoises are particularly common in the Bay of Fundy, and to a lesser degree along the outer coast of Nova Scotia, the Northumberland Strait, and the Gulf of St. Lawrence. Harbour porpoises are rarely found in water deeper than 125 m (Gaskin 1992), and feed on various coastal schooling fish species, such as herring and mackerel. Harbour porpoises usually travel in loose groups, and larger concentrations will often aggregate in rich feeding areas. Migratory movements of the harbour porpoise are poorly understood. It is thought that most animals move offshore and southward during the winter to calve, although they are occasionally observed in the winter months in the Bay of Fundy.

Harbour porpoises are small animals when compared to other cetaceans, rarely exceeding more than 1.5 m, and mature quickly in three to four years (Gaskin 1992). Harbour porpoises, being a small and fast growing species, are relatively short-lived, usually not living past the age of fifteen. Although reproduction rates are higher than most other cetaceans, harbour porpoises are still threatened by several anthropogenic sources. Perhaps the most serious of these human impacts on porpoise populations is accidental entanglement in commercial fishing gear. They are also threatened by habitat destruction and human disturbance in their coastal habitat. For these reasons, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists the harbour porpoise as a species of special concern (COSEWIC 2003). Harbour porpoises are likely the most common cetacean in the Strait of Canso and Approaches, given their preference for shallow waters, and can be expected during the late spring, summer and early fall months (S. Smith, pers. comm., 2003). Numbers of individuals would likely be related to schooling fish prey species in the general region.



BEAR HEAD LNG TERMINAL

Figure 6.8

Generalized Whale & Dolphin Concentration & Migration Patterns

Highest Concentration of Species Distribution

Tooth Whales
- Pilot Whale
- Northern Bottlenose Whale

Baleen Whales
- Minke
- Fin
- Blue
- Humpback
- Right (Rare Occurance)
- Sei

Bathymetry (metres)
- 0 - 50
- 51 - 100
- 101 - 200
- 201 - 400
- 401 - 500
- 501 - 1000
- 1001 - 2000
- 2001 - 3000
- 3001 - 3500
- 3501 - 4000
- 4001 - 4500
- 4501 - 5000
- 5001 - 5500

N

0 10 20 30 40 50

Kilometres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Zone: 20
Datum: NAD 83
Scale: 1:1,200,000
Project Number: NSD17393
Date: April 19, 2004

Source: Sutcliffe & Brodie (1977)
Kenney (1994)

Jacques Whitford

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The long-finned pilot whale (*Globicephala melaena*) is found in cool to temperate waters and uses a wide variety of habitats, from deep pelagic regions off the Continental Shelf, to inshore bays and fjords. The presence of long-finned pilot whales in inshore waters is attributed to high concentrations of prey species, most notably squid. Pilot whales are highly social animals and live within tightly knit social groups or pods, large groups of several or more pods are often observed in rich feeding areas. Pilot whales are a heavy-bodied species and grow to over 6 m in length. In the past, pilot whales were hunted in Atlantic Canada in "drive fisheries", where pods of whales were forced to beach themselves with the aid of motorized vessels. These hunts have ceased and pilot whale populations appear to be healthy off of Nova Scotia resulting in no special status designated by COSEWIC. Pilot whales are particularly abundant in the summer months around Northern Cape Breton and especially in Gulf of St. Lawrence waters (Breeze *et al*. 2002). Pilot whales are one of the main species targeted by whale watching cruises leaving such Cape Breton ports as Ingonish, Pleasant Bay, and Cheticamp. Pilot whales may be found in the general Project area from time to time in the summer months, likely entering shallow waters in pursuit of prey (D. Sinclair, pers. comm., 2003; S. Smith, pers. comm., 2003; J. Conway, pers. comm., 2003).

The minke whale (*Balaenoptera acutorostrata*) has a wide distribution in coastal and offshore waters of the globe, being most abundant in cool and temperate seas. The minke whale is the second smallest of the baleen whales, usually not exceeding 10 m in length. The minke whale is usually found singly and individuals are often repeatedly observed in the same general areas, indicating that they may maintain loosely defined home ranges for part of the year. Migratory movements of minke whales are not well known in the North Atlantic. Although they are observed throughout the year, it is thought that many individuals move offshore and/or to the south for the winter months (Breeze *et al*. 2002). The minke whale is considered common in Atlantic Canadian waters and has no special regulatory status. Minke whales are frequently observed in coastal waters around Nova Scotia and are likely present in the study area during the spring, summer and fall, especially when high concentrations of prey species are in the area (D. Sinclair, pers. comm., 2003; S. Smith, pers. comm., 2003; J. Conway, pers. comm., 2003).

There is the potential for other whale species to be present in the study area, however, these species would be uncommon transients given their preference for deeper waters, and would likely enter the study area in pursuit of prey. From discussions with Smith, Conway, and Sinclair (pers. comm., 2003), the fin whale (*Balaenoptera physalus*), the Atlantic white sided dolphin (*Lagenorhynchus acutus*), the white-beaked dolphin (*Lagenorhynchus albirostris*), and a beached Blue Whale (*Balaenoptera musculus*) have been seen in the Strait of Canso or Approaches. The fin whale is the second largest species of whale, after the blue whale, growing to over 25 m in length. Fin whales are common around Cape Breton, the outer coast of Nova Scotia, and the Bay of Fundy. They are known to congregate in the late winter and early spring to feed on herring in Chedabucto Bay and the approaches of Halifax Harbour (NSMNH 1997). Fin whales were hunted intensively before the ban on commercial whaling in the North Atlantic, and populations have yet to fully recover. As such, they are listed as a Species of Special Concern by COSEWIC (COSEWIC 2003) and as Endangered by the National Marine Fisheries

Service (NMFS 2003). The Atlantic white-sided dolphin and the white-beaked dolphin are gregarious fish eaters, that prefer moderately deep temperate to cold waters of the North Atlantic (Davis *et al*. 1998); however, the white-beaked dolphin is usually found in cooler waters than the white-sided dolphin. Both species are common and have no special regulatory status. Blue whales are found on the western edge of Sable Bank, over Emerald Bank and in the channel between Emerald and LaHave Banks (Breeze *et al*. 2002). Blue whales also travel along the edge of the Scotian Shelf and into the Gulf of St. Lawrence during the summer and fall and may be present in any area of high phytoplankton productivity (*i.e.,* areas with abundant krill, copepods, herring and capelin) (Breeze *et al*. 2002; Thomson *et al*. 2000). The blue whale is listed as endangered by COSEWIC and by the National Marine Fisheries Service (COSEWIC 2003; NMFS 2003). North Atlantic right whale (*Eubalaena glacialis*) occurrence in the vicinity of the project were deemed unlikely (S. Smith, Pers. Comm. 2004). The lack of observation of this species in the project area doesn't necessarily mean that the whales are not present in the area. However areas of concentrations of the north Atlantic right whale in Atlantic Canada have been identified and include; Roseway Basin, the Bay of Fundy and the north shore of the Gulf of St. Lawrence. All of these areas are located far from the Project area. The north right Atlantic right whale is listed as endangered (COSEWIC 2003). To protect this species two sanctuaries were created; one in the Bay of Fundy and another at Roseway Basin.

Pinnipeds

Historically, six species of seals have been recorded from Nova Scotian waters; however, only four species are likely to be encountered in the study area. These include: harbour seal (*Phoca vitulina*); grey seal (*Halichoerus grypus*); hooded seal (*Cystophora cristata*); and harp seal (*Phoca groenlandica*) (J. Conway, pers. comm., 2003; D. Sinclair, pers. comm., 2003). Grey and harbour seals occur year-round in Nova Scotian waters and are expected to be common in the study area, whereas hooded and harp seals are seasonal visitors to Nova Scotian waters.

Grey seals are large animals, with males averaging 225 cm in length and weighing between 300-350 kg. Females are considerably smaller; the average female is 200 cm and weighs 150-200 kg. Grey seals eat a wide variety of fish and invertebrate species, with herring, cod and mackerel being the most important in Nova Scotian waters (NSMNH 1997). Grey seals in Nova Scotian waters belong to the western North Atlantic stock. Several breeding colonies exist in Nova Scotia, these being Amet Island in the Northumberland Strait, Hay Island and the Basques Islands off Cape Breton, Sable Island, Camp Island off the east coast of Nova Scotia and a group which breeds on the shifting sea ice in the Northumberland Strait. Grey seals form large breeding groups on sea ice or undisturbed coasts and islands, and give birth to their pups on land or ice between December and February. After mating, grey seals travel widely from their breeding grounds. In spring, summer, and fall they often feed in coastal areas, are common all along the coast of Nova Scotia during this time, and thus are likely found within the study area. Grey seals are common and have no special regulatory status.

Harbour seals are smaller than grey seals, with males reaching a maximum weight of 110 kg. Harbour seals have a varied diet, common items include herring, squid, flounder and gaspereau (NSMNH 1997). Harbour seals pup on remote ledges, islands, sandbars and rocky beaches from late April to June. They also haul out on land in early August to moult. For the balance of the spring, summer and fall months, harbour seals are common all around Nova Scotia in bays, inlets, estuaries and, occasionally, in fresh waters; harbour seals can be expected in the study area during this time. In winter, harbour seals move further offshore to avoid sea ice and frozen coastal bays and inlets. Harbour seal populations are considered to be stable in Nova Scotia (NSMNH 1997) and have no special regulatory status.

Harp seals are distributed mainly to the north of the study area (Thomson *et al.* 2000). They pup and breed on pack ice in the Gulf of St-Lawrence and off the coast of Labrador (Sergeant 1991). Juvenile harp seals have been observed more frequently in Nova Scotian waters in recent years, perhaps due to a growing population (Stevick and Fernald 1998). Harp seals would likely be winter and spring visitors to the study area.

Hooded seals are a northern species, breeding on pack ice off southern Labrador, northeastern Newfoundland, off southern Greenland, and to a lesser extent in the Gulf of St. Lawrence. Hooded seals are known to be great wanderers, appearing in unexpected places. Juveniles have been found as far south as Florida, and they are regularly observed on Sable Island during the winter months (Reeves *et al.* 1992). Given hooded seals' tendencies to travel far distances from their northern breeding grounds, they have the potential to be found within the study area.

6.1.8 Freshwater Fish and Fish Habitat

A field survey of fish and fish habitat in the vicinity of the proposed Project site was conducted in July 2003. There are two unnamed watercourses in the property boundary of the Project site that could potentially be affected by Project activities (Figure 6.3); these are described below as Stream A and Stream B. Stream A is located west of the Project footprint and Stream B to the east of the footprint.

Stream A

The outlet of Stream A into the Strait of Canso is located in an area with a low grade, passable by fish. The width of the stream at this location is approximately 2 m with a water depth of approximately 10 cm (Photo 1, Appendix F).

Water depth in rifle zones throughout the length of the stream is consistent at 10 cm. Pools along the length of the stream vary greatly in size and depth. The dominant stream characteristics are riffle-pool sequences with some areas containing falls and cascades (Photos 2, 3, and 4, Appendix F). The majority of the substrate in the stream is composed of pebble- and cobble-sized rocks with a few boulders interspersed. Fine material was deposited in the pool areas.

Approximately 30 m upstream of the Strait of Canso, the stream flows underneath a gravel road through a 1.5 m corrugated metal culvert (Photo 5, Appendix F). Water levels throughout the culvert vary from 25 cm in the downstream portion to 10 cm in the upstream portion.

Overall, canopy cover over the stream ranges from 75 to 90% except for an area of the stream in which flow is controlled by a concrete structure (Photos 6 and 7, Appendix F). Downstream of the concrete structure, there are signs that the stream had recently overflowed the channel banks. This retention structure is an impediment to fish passage. At the time of the survey, water flowing out of the retention pond has a drop of approximately 4 m before entering the culvert seen in Photo 6 (Appendix F). Upstream of the retention pond a portion of the stream bed was probably engineered. The substrate in this portion of the stream is composed of similar size rocks (Photo 8, Appendix F).

In the portion of the stream located upstream of the retention pond, the stream contains less riffle area and more pools (Photo 9, Appendix F). The substrate of the stream contains more deposited material (fines) and less cobble size rocks.

Although Stream A was sampled using an electrofisher, no fish were observed during the site visit. The lower portion of the stream is potential fish habitat; however, the concrete structure is clearly an impediment to fish passage. Also, 35 m downstream of this structure, the stream flows over a rock outcropping approximately 2.5 m high, also an impediment to fish.

Stream B

The head of the stream is made up of a multitude of drainage channels flowing into a wetland located north of Bear Island Road. The stream flows out of the wetland and through a 60 cm wide culvert under Bear Island Road. Overall, this stream is approximately 30 cm wide with an average depth of 15 cm (Photo 10, Appendix F). Canopy cover ranges from 70 to 100%. Substrate composition consists mostly of fines with a few cobble- and boulder-sized rocks interspersed due to the low grade from the headwater to the outlet into Bear Island Cove in the Strait of Canso. The dominant stream types are long pools of standing water with some riffle areas. Vegetation along both sides of the stream consists mostly of alders, maples, firs, larch, mosses, and ferns (Photo 11, Appendix F). The stream flows into a wide (4-5 m) meandering channel before emptying into Bear Island Cove (Photo 12, Appendix F).

Although Stream B was sampled using an electrofisher, no fish were observed during the site visit. However, with consistently high water levels during the summer months and higher pH levels, this stream would be adequate fish habitat.

Water Chemistry

Water samples were obtained at both streams (Figure 6.3). These samples provide baseline information regarding the water quality of the streams (Table 6.22)

Table 6.22 Water Chemistry and Metal Analysis from Fish and Fish Habitat Survey, July 2003

Parameters	Units	Stream A	Stream B	CCME guidelines
Sodium	mg/L	26.1	5.6	n/a
Potassium	mg/L	9.4	0.5	n/a
Calcium	mg/L	51	1.3	n/a
Magnesium	mg/L	8.4	0.6	n/a
Alkalinity (as $CaCO_3$)	mg/L	<5	<5	n/a
Sulfate	mg/L	200	<5	n/a
Chloride	mg/L	10	8	n/a
Reactive Silica (as SiO_2)	mg/L	10	2	n/a
Ortho Phosphate (as P)	mg/L	<0.02	<0.02	n/a
Phosphorus	mg/L	<0.1	<0.1	n/a
Nitrite	mg/L	<0.01	<0.01	0.06
Nitrate + Nitrite (as N)	mg/L	<0.05	<0.05	n/a
Nitrate (as N)	mg/L	<0.05	<0.05	Narrative
Ammonia (as N)	mg/L	<0.05	<0.05	0.019
Color	TCU	12	79	n/a
Turbidity	NTU	0.6	7.6	n/a
Conductance (RCAp)	uS/cm	561	48	n/a
pH	**Units**	**4.8**	**4.8**	**6.5-9**
Hardness (as $CaCO_3$)	mg/L	162	5.7	n/a
Bicarbonate (as $CaCO_3$)	mg/L	<5	<5	n/a
Carbonate (as $CaCO_3$)	mg/L	<5	<5	n/a
Total Suspended Solids	mg/L	2.5	18.5	n/a
TDS (Calculated)	mg/L	318	26	n/a
Aluminum	**: g/L**	**1000**	**550**	**5-100**
Antimony	: g/L	<2	<2	n/a
Arsenic	: g/L	<2	<2	5
Barium	: g/L	32	19	n/a
Beryllium	: g/L	<2	<2	n/a
Bismuth	: g/L	<2	<2	n/a
Boron	: g/L	990	10	n/a
Cadmium	**: g/L**	**0.4**	**<0.3**	**0.017**
Chromium	: g/L	<2	<2	1-8.9
Cobalt	: g/L	5	1	n/a
Copper	: g/L	3	3	2-4
Iron	**: g/L**	230	**1500**	**300**
Lead	: g/L	1.4	0.9	1-7
Manganese	: g/L	710	200	n/a
Molybdenum	: g/L	3	<2	73
Nickel	: g/L	37	3	25-125
Selenium	: g/L	<2	<2	1
Silver	: g/L	<0.5	<0.5	0.1
Strontium	: g/L	460	10	n/a
Thallium	: g/L	0.7	<0.1	0.8

Table 6.22 Water Chemistry and Metal Analysis from Fish and Fish Habitat Survey, July 2003				
Parameters	**Units**	**Stream A**	**Stream B**	**CCME guidelines**
Tin	: g/L	<2	<2	n/a
Titanium	: g/L	5	3	n/a
Uranium	: g/L	0.2	<0.1	n/a
Vanadium	: g/L	<2	3	n/a
Zinc	**: g/L**	**38**	17	**30**
Bold font indicates that the parameter levels exceed CCME guidelines.				

The pH of both streams is well below the CCME guidelines, resulting in unsuitable habitat for aquatic life. Stream A has higher concentrations of calcium and magnesium than Stream B resulting in harder water. The concentration of sulfate in Stream A is significantly higher than in Stream B. Excessive sulfate can lead to acidification of the system. Sources of sulfate are likely from the natural weathering of rocks, oxidation of sulphide materials, and deposition from acid rains.

Aluminum exceeded CCME guidelines in both streams. Cadmium and zinc levels in Stream A and iron levels in Stream B exceeded CCME guidelines. However, high levels of iron and aluminum and low pH are widespread in the aquatic systems of Nova Scotia and are related to natural processes and anthropogenic deposits. The location of the fly-ash pile near the headwaters of Stream A might contribute to the elevated levels of metals observed in this stream.

Species at Risk

A search of the Atlantic Canada Conservation Data Centre (ACCDC) for species with special status (August 2003) revealed that within this database, no records of freshwater species with special status exist in the Project area.

6.1.9 Wildlife and Terrestrial Habitat

6.1.9.1 Wetlands

Information regarding wetlands within the study area was derived from several sources, including Wetland Atlas-Wetland Protection mapping (Canadian Wildlife Service 1984), 1:10,000 scale topographic mapping, 1:10,000 scale colour air photos, and two site visits for each wetland. Air photos and the Wetland Atlas (CWS 1984) were consulted to identify wetlands in the study area prior to the field surveys. Five wetlands were identified in the study area and evaluated (Figure 6.3). Three of the wetlands are found entirely within the study area while two are partially contained within the study area. The following sections describe each of the five wetlands assessed in the field. Full wetland evaluations are included in (Appendix G) where applicable. A sixth wetland within the ANEI property was subsequently identified following establishment of the property boundary and potential fenceline.

Wetland 1

Wetland 1 (Figure 6.3) is 1.87 ha and is a wetland complex composed of slope fen, mixedwood treed spring swamp and coniferous treed basin bog. The wetland supports four distinct plant communities. Treed bog is present at the eastern end of the wetland. The dominant tree species here are tamarack (*Larix laricina*), black spruce (*Picea mariana*) and red maple (*Acer rubrum*). The shrub layer is relatively sparse compared to other treed bogs and is composed mainly of huckleberry (*Gaylussacia baccata*), witherod (*Viburnum nudum*), winterberry (*Ilex verticillata*), red chokeberry (*Aronia arbutifolia*), and speckled alder (*Alnus incana*). The ground vegetation consists mostly of sphagnum moss (*Sphagnum spp.*), cinnamon fern (*Osmunda cinnamomea*), bunchberry (*Cornus canadensis*), and cottongrass (*Eriophorum virginicum*). The low tree and shrub cover in this community is attributable to past beaver flooding which caused heavy mortality of tree and shrub species.

This wetland is the headwaters of a small stream which passes through the treed bog. The banks of the stream support a plant community dominated by a mixture of sphagnum moss, burreed (*Sparganium americanum*), narrow-leaved sundew (*Drosera intermedia*), beakrush (*Rhyncospora alba*), and swamp candles (*Lysimachia terrestris*). There are no tree or shrub species associated with this plant community.

A long arm of wetland habitat extends from the western side of the wetland. This arm supports two plant communities. At the tip of the arm is a slope fen habitat which is characterized a relatively dense sward of grasses and sedges. The most abundant species of the ground vegetation layer include sedges (*Carex stricta, C. nigra*, and *C. canescens*), sphagnum moss, blue-joint (*Calamagrostis canadensis*), creeping bent-grass (*Agrostis stolonifera*), and swamp candles. Tree cover consists of scattered stunted red maple and tamarack. The shrub layer is also sparse and consists mainly of trailing blackberry (*Rubus hispidus*) and winterberry.

Proceeding along the arm of wetland habitat from west to east, slope fen habitat gives way to mixedwood treed slope spring swamp. A relatively dense cover of immature trees and shrubs characterizes the spring swamp plant community. The most abundant tree species are red maple, tamarack, black spruce and white pine. Common shrub species include winterberry, speckled alder and huckleberry. The ground vegetation layer consists mainly of sphagnum moss, cinnamon fern and bunchberry.

The wetland has not been mapped on the Wetlands Atlas for Nova Scotia so no Golet score (a wetland evaluation system used to determine the value of wetlands as wildlife habitat) is available for the wetland. During the field survey all species of bird, mammal, reptile and amphibian detected within the wetland were recorded. Wildlife species were detected on the basis of visual sightings, vocalizations, tracks, faeces, skeletal remains, and distinctive spoor such as characteristic bite marks or dens.

During the field survey fourteen bird species were recorded in or adjacent to the wetland. These included: American Goldfinch; White-throated Sparrow; Northern Junco; Common Yellowthroat; Black-capped Chickadee; American Robin; Yellow-rumped Warbler; Nashville Warbler; Yellow-bellied Flycatcher; Magnolia Warbler; Swamp Sparrow; Purple Finch; Golden-crowned Kinglet; and Blue Jay. It is likely that five of these species breed in the wetland. These include: White-throated Sparrow; Northern Junco; Common Yellowthroat; Yellow-bellied Flycatcher; and Swamp Sparrow. No mammals were detected in the wetland during the field surveys. The presence of the remnants of a beaver dam at the outflow of the wetland indicates that beaver once occupied the wetland. Herpetiles found in the wetland included green frog, leopard frog, pickerel frog, and northern spring peeper. The wetland provides suitable breeding habitat for all of these species. The wetland has relatively high potential to provide breeding habitat for four-toed salamanders, an uncommon amphibian species. The four-toed salamander is considered to be sensitive to human activities (NSDNR 2003a). Suitable breeding habitat (sphagnum moss hummocks adjacent to pools) was present at the eastern end of the wetland. Well developed sphagnum moss hummocks are most frequently used as nest sites by four-toed salamanders. The sphagnum hummocks in Wetland 1 were low suggesting that this habitat is sub-optimal. Wetland 1 is the headwaters of a small stream. No fish were observed in the stream during any of the field surveys.

A vegetation survey was conducted in the wetland to determine if any rare vascular plants were present. A total of 72 species were found in the wetland, none of which is considered to be rare in Nova Scotia (NSDNR 2003a; NSDNR 2003b) or Canada (COSEWIC 2003).

There is no evidence to indicate that the wetland is used for any commercial or recreational activities. Trees in the wetland are relatively young and a number of snags are present suggesting that there have been water level fluctuations. A woods road crosses the outflow of the wetland and it is possible that construction of the road may have affected the hydrology of the wetland. There are also the remains of an old beaver dam at this location, so it is difficult to determine whether past disturbances of wetland hydrology are due mainly to road construction or beaver activity.

Wetland 2

This wetland is located on a small stream located west of the Project footprint (Figure 6.3). It is 3.8 ha in size and is a wetland complex composed of mixedwood treed stream swamp, coniferous treed stream swamp and tall shrub dominated stream swamp.

There are three distinct plant communities present in this wetland. The largest plant community is the tall shrub swamp community which occupies the center of the wetland. This community is dominated by a mixture of tall and low shrub species, the most abundant of which are speckled alder, winterberry, huckleberry, lambkill, and witherod. Tree cover is sparse and consists mainly of red maple and black spruce. Sphagnum moss and sedge (*Carex stricta*) are the most abundant ground vegetation species.

Bog fern (*Thelypteris simulata*), cinnamon fern and marsh St. John's-wort are also common species of the ground vegetation layer.

Mixedwood treed swamp is found around the margin of the wetland. This community is similar in species composition to the tall shrub swamp community and represents a later stage in plant community succession in the wetland. The tree layer is open but much better developed than in the tall shrub swamp community. Red maple and black spruce are the dominant tree species along with a small number of mountain white birch. The shrub layers consists mainly of speckled alder and young trees. The ground vegetation layer consists of a mixture of sphagnum moss, sedge (*Carex stricta*), bog fern, and cinnamon fern.

Coniferous tree stream swamp occupies a small area at the eastern end of the wetland. The tree canopy is relatively well developed and is composed mainly of tamarack along with a few red maple and black spruce. The shrub layer consists of a mixture of shrubs and advanced tree regeneration. The most abundant species of the shrub layer include black spruce, lambkill, huckleberry, winterberry, speckled alder, and witherod. The most abundant ground vegetation species include sphagnum moss, sedge (*Carex stricta*), cinnamon fern, and bog aster (*Aster nemoralis*).

Snags are common in the wetland indicating that there has been heavy tree mortality within the past few decades. This tree mortality is probably attributable to fluctuations in water level in the wetland, which may in turn be attributable to beaver activity, or anthropogenic changes in water input to the wetland. The remains of an old beaver dam were found at the outflow of the wetland. The stream which flows into the wetland drains another wetland which is used as an ash disposal site by Nova Scotia Power Inc. The ash is transported as a slurry which would augment the flow rates of the stream and may have altered the hydrology of the wetland enough to cause tree mortality. Black spruce is tolerant of wet conditions but is very sensitive to water level fluctuations. It is not possible to determine which of these activities has resulted in the tree mortality event. The entire wetland was probably composed of mixedwood treed stream swamp prior to the water level fluctuation. Since then the flora has stabilized and eventually mixedwood treed stream swamp will once again be the most abundant plant community. The tall shrub swamp community represents a stage in the succession of plant communities on the wetland.

Wetland 2 has a Golet score of less than 60 indicating that it does not provide a high diversity of wildlife habitat. During the field survey seven bird species were recorded in or at the edge of the wetland including White-throated Sparrow, Common Yellowthroat, Black-and-white Warbler, Nashville Warbler, Olive-sided Flycatcher, Blue-headed Vireo, Swamp Sparrow and Hermit Thrush. Species which are likely to breed in the wetland include White-throated Sparrow, Common Yellowthroat, Olive-sided Flycatcher, and Swamp Sparrow. Varying hare and white-tailed deer were the only mammals recorded in the wetland although there was evidence of past beaver activity. No reptiles were observed in the wetland; however, three species of amphibian were detected. Larvae of green frog and yellow-

spotted salamander were found in the wetland and adult pickerel frog and green frog were observed. None of the wildlife species observed in the wetland is considered to be rare or sensitive to human activity. A vegetation survey was conducted in the wetland to determine if any rare vascular plant species were present. A total of 49 species of vascular plant were found in the wetland, none of which is considered to be rare.

There is no evidence to indicate that the wetland is used for any commercial activities such as agriculture, trapping, peat extraction or tourism and recreation. The wetland may help to improve water quality in the stream that passes through it. This stream flows from another wetland that receives ash slurry. Near the inflow to Wetland 2 a white precipitate was found on the undersides of rocks in the stream; downstream of Wetland 2 this precipitate was not found.

Wetland 3

This wetland is located approximately 93 m south of Wetland 2 (Figure 6.3). It is a wetland complex composed of coniferous treed stream swamp and coniferous treed basin bog. The wetland evaluation for Wetland 3 is presented in Appendix G. The wetland is 0.1 ha in size and supports two plant communities. The coniferous treed stream swamp community is found along the stream which flows out of Wetland 2. It is characterized by an open tree canopy composed of a mixture of black spruce and tamarack. The shrub understory is rather sparse and is composed largely of lambkill, witherod, false holly, huckleberry and stunted black spruce. The ground vegetation layer consists mainly of sphagnum moss, bog fern and sedge (*Carex stricta*).

The coniferous treed basin bog community is found in a bowl shaped depression located west of the stream. Tree cover is sparse and consists of tamarack, black spruce and red maple. Stunted black spruce, tamarack and red maple are abundant in the shrub layer along with bayberry (*Myrica pensylvanicum*), huckleberry, lambkill, and false holly. Sphagnum is the most abundant ground vegetation species along with beak-rush (*Rhyncospora alba*), small cranberry (*Vaccinium oxycoccus*), cotton-grass (*Eriophorum virginicum*), and bog aster.

This wetland has not been mapped on the Wetlands Atlas for Nova Scotia so no Golet score is available for it. During the field survey four bird species were recorded in or adjacent to the wetland including Nashville Warbler, Common Yellowthroat, Swamp Sparrow, and Northern Flicker. The wetland provides suitable nesting habitat for all of these species. No mammals, reptiles or amphibians were recorded in the wetland during the field surveys.

A vegetation survey was conducted in the wetland to determine if any rare vascular plants were present. A total of 36 species were found in the wetland, one of which is considered to be rare in Nova Scotia. This was southern twayblade (*Listera australis*) which was found in the coniferous treed stream swamp plant community on the western side of the stream (Figure 6.3). Southern twayblade is a red listed

species (NSDNR 2003a) indicating that the Nova Scotia population is considered to be at risk. Four southern twayblade were found in the coniferous treed stream swamp in association with sedge (*Carex stricta*) and sphagnum moss (*Sphagnum spp.*).

Wetland 3 is not used for commercial purposes and does not appear to be used for recreational activities.

Wetland 4

Wetland 4 is 0.2 ha in size and is located 55 m south of Wetland 3 (Figure 6.3). It is a coniferous treed basin bog located in a small bowl shaped depression. Tree cover consists largely of a mixture of stunted black spruce and tamarack. The shrub layer is well developed and is composed largely of huckleberry, false holly, Labrador tea (*Ledum groenlandicum*), and witherod. The dominant species of the ground vegetation layer include sphagnum moss, beak-rush (*Rhyncospora alba*), small cranberry, and three-leaved false Solomon's-seal (*Smilacina trifolia*).

The wetland has not been mapped on the Wetlands Atlas for Nova Scotia so no Golet score is available for it. Four bird species were observed in or near the wetland including, White-throated Sparrow, Common Yellowthroat, Black-and-white Warbler, and Hermit Thrush. Suitable nesting habitat is present in the wetland for all of these species with the exception of the Black-and-white Warbler. A Hermit Thrush nest was found in the wetland during the survey. No mammals or amphibians were recorded in the wetland. The wetland provides little amphibian breeding habitat since there is no open water. Two reptiles were observed in the wetland including Maritime garter snake and eastern smooth green snake. None of the animals observed in or near the wetland is considered to be rare or sensitive to human activities.

A vegetation survey was conducted in the wetland to determine if any rare vascular plants were present. A total of 28 species were found in the wetland. One of these species, northern commandra (*Geocaulon lividum*), is considered to be rare in Nova Scotia. This species is yellow listed by NSDNR (2003a) indicating that the Nova Scotia population is considered to be sensitive to anthropogenic activities or natural perturbations. Approximately 430 northern commandra were found in barrens habitat to the east of the wetland (Figure 6.3). Fifty northern commandra were found at the eastern edge of the wetland.

There is no evidence to indicate that Wetland 4 is used for commercial or recreational purposes. It has not been adversely affected by past anthropogenic activities.

Wetland 5

This wetland is only 0.1 ha in size and is located near the western tip of Wetland 1 (Figure 6.3). It is classified as a coniferous treed slope bog. Tree cover in this wetland is sparse and patchy consisting of a mixture of black spruce, tamarack and red maple. There is little shrub cover which consists largely of

huckleberry and winterberry. The surface of the bog consists of a continuous sphagnum moss carpet that is punctuated by patches of cinnamon fern, New York fern (*Thelypteris noveboracensis*), bunchberry (*Cornus canadensis*), and cotton-grass.

No birds, mammals, reptiles or amphibians were detected in the wetland during the site visits. A vegetation survey conducted in the wetland revealed the presence of 37 species of vascular plant, none of which is considered to be rare. Wetland 5 does not appear to be used for commercial or recreational purposes and it has not been adversely affected by past human activities.

Wetland 6

A sixth wetland, potentially affected by the Project, was identified subsequent to the field surveys once the property boundaries were surveyed (Figure 6.3). This wetland, approximately 0.7 ha in size could be affected by fence installation. Depending on the final fence location and design, a follow-up wetland survey at this location may be required.

6.1.9.2 Mammals

Table 6.23 lists the mammal species recorded on or near the proposed LNG terminal property during the field surveys as well as species that have been recorded in nearby areas during other field surveys. None of these species are considered to be rare in Nova Scotia (NSDNR 2003a) or Canada (COSEWIC, 2003). NSDNR (2003b) lists thirteen species of terrestrial mammals as sensitive (yellow listed) or at risk (red listed) in Nova Scotia. Four of these species are relatively large mammals including moose, Canada lynx, American marten, and fisher (*Martes pennanti*). Moose is the only one of these mammals which has been recorded in or near the study area. Moose have been observed west of the study area. Only the mainland moose population is considered to be at risk. The Cape Breton population consists of animals introduced from Alberta and this population is large enough to support a limited sport hunt and aboriginal hunting and therefore is not considered a constraint to development.

Table 6.23 Mammals Recorded at or near Bear Head

Binomial	Common Name
Lepus americanus	Showshoe hare
Tamias striatus	Eastern chipmunk
Tamiasciurus hudsonicus	American red squirrel
Castor canadensis	Beaver
Peromyscus maniculatus	Deer mouse
Clethrionomys gapperi	Gapper's red-backed vole
Napaeozapus insignis	Woodland jumping mouse
Zapus hudsonicus	Meadow jumping mouse
Ondatra zibethica	Muskrat
Microtus pennsylvanicus	Meadow vole
Erithizon dorsatum	Porcupine
Vulpes vulpes	Red fox

Table 6.23 Mammals Recorded at or near Bear Head	
Binomial	**Common Name**
Canis latrans	Coyote
Ursus americanus	American black bear
Procyon lotor	Racoon
Odocoileus virginianus	White-tailed deer
Alces alces	Moose

Small mammals considered to be sensitive in Nova Scotia include southern flying squirrel, hoary bat, red bat, silver-haired bat (*Lasionycteris noctivagans*), eastern pipistrelle (*Pipistrellus subflavus*), northern long-eared bat (*Myotis septentrionalis*), little brown bat (*Myotis lucifugus*), long-tailed shrew, and Gaspe shrew. Long-tailed shrew and Gaspe shrew are typically found in talus slopes and steep ravines. This habitat type is not present in the study area and these species are not expected to be present. Hibernating bats such as little brown bat, northern long-eared bat, and eastern pipistrelle are most sensitive to anthropogenic activities at their hibernation sites where large numbers of bats congregate. These species are typically widely dispersed during the late spring, summer and early autumn and their populations are much less vulnerable to disturbance or habitat loss. These species typically hibernate in solution caves or abandoned mine shafts, neither of which is present on or near the proposed LNG terminal site. Migratory bats such as the red bat and hoary bat are not present during the winter months. Little is known about red and hoary bats in Nova Scotia. These species are probably present mainly from late May to late September (Banfield, 1974) although there are records of these species in Nova Scotia from October and November (Gilhen and Scott 1981). Both species roost in trees and are rarely found in caves. They are frequently found in close proximity to humans, roosting in shade trees in towns and villages. There is some potential for these species to be present in the study area; however, the study area does not contain any known unique features that would make it particularly attractive to these species. The known distribution of southern flying squirrels is restricted to the area around Kejimkujik National Park and the Gaspereaux River valley. It is unlikely that this species would be present on Cape Breton Island.

Sensitive mammal habitats include deer and moose wintering areas. White-tailed deer typically gather in Deer Wintering Areas (DWA) when snow depths exceeding 30 to 45 cm make travel difficult. During such times, deer gather in herds of up to 25 animals in dense softwood stands located adjacent to water and food sources. These stands are generally found in riparian habitats, seashores, or on south facing slopes at elevations under 153 m. On mainland Nova Scotia, winters are usually mild and DWA are used infrequently; however, in Cape Breton, DWA are used regularly. A review of NSDNR Significant Habitat mapping (NSDNR 2003c) indicated that no deer wintering areas are present in or near the study area. Similarly, moose will gather in wintering areas when snow depths exceed 100 cm. They move into lowland areas with less snow cover and nearby food sources. No moose wintering areas are known from the study area or adjacent to it.

6.1.9.3 Rare Herpetiles

Table 6.24 lists the herpetile species (reptiles and amphibians) that have been identified in the study area as well as in the general vicinity of the study area.

Table 6.24 Herpetile Species Found at or Near Bear Head

Common Name	Binomial	Found in Study Area	Found in General Area
Red-backed Salamander	*Plethodon cinereus*	X	X
Four-toed Salamander	*Hemidactylium scutatum*		X
Yellow-spotted Salamander	*Ambystoma maculatum*	X	X
Blue-spotted Salamander	*Ambystoma laterale*		X
Red-spotted Newt	*Notophthalmus viridescens viridescens*		X
Eastern American Toad	*Bufo americanus americanus*		X
Northern Spring Peeper	*Pseudocaris crucifer crucifer*	X	X
Green Frog	*Rana clamitans melanota*	X	X
Wood Frog	*Rana sylvatica*	X	X
Northern Leopard Frog	*Rana pipiens*	X	X
Pickerel Frog	*Rana palustris*	X	X
Mink Frog	*Rana sepentrionalis*		X
Wood Turtle	*Clemmys insculpta*		X
Northern Redbelly Snake	*Storeria occipitomaculata occipitomaculata*	X	X
Maritime Garter Snake	*Thamnophis sirtalis pallidula*	X	X
Eastern Smooth Green Snake	*Liochlorophis vernalis borealis*	X	X

Sixteen species of amphibian and reptile have been recorded in the general vicinity of the study area (southwestern Cape Breton). Ten of these species were recorded in the study area. None of the species found in the study area is considered to be rare or sensitive in Nova Scotia (NSDNR 2003a; NSDNR 2003b) or Canada as a whole (COSEWIC 2003). Two of the species found in the general area are considered to be rare or sensitive including wood turtle and four-toed salamander.

Wood turtles are listed as a species of special concern by COSEWIC (2003) and as a vulnerable species under the Nova Scotia *Endangered Species Act*. In southwestern Cape Breton, wood turtles are associated with the River Inhabitants and its tributaries. Wood turtles are typically associated with streams and rivers and the associated rich intervale forest, shrub thickets, meadows and farmland found along these water courses. They prefer streams with sand or gravel and sand bottoms but rocky bottoms are also used. Wood turtles venture into terrestrial habitats adjacent to streams and rivers but characteristically remain within linear home ranges. These home ranges are 1 to 6 ha in size and are centred on a suitable river or stream where unvegetated sandy beaches and banks provide nesting sites. Traditional natural nesting sites consist of sandy river beaches but may also include some man made sites such as railroad embankments and road sides. Wood turtles traverse their ranges all summer long. Some turtles may travel considerable distances up small tributaries that offer good feeding opportunities but lack suitable nesting sites or hibernacula. These smaller streams may serve as dispersal corridors between populations on different river systems. No wood turtles were detected in the study area during the field surveys nor is suitable wood turtle habitat present within the study area. The study area is

located on a peninsula and streams present within it discharge directly to the sea; it is therefore highly unlikely that wood turtles would pass through the study area during their summer forays up small tributaries.

The four-toed salamander is listed as a yellow species by NSDNR (2003a) indicating that it is sensitive to anthropogenic activities. Local herpetologists generally believe that the four-toed salamander is more abundant and widespread than existing records indicate. This is attributable to the cryptic nature of this species. Four-toed salamanders are rarely found away from cover. During the breeding season females nest in sphagnum moss hummocks; during the rest of the year this species is present under stones, logs and other cover in forest habitats. They emerge from cover only at night. Four-toed salamanders are most easily detected at their breeding sites.

A recent study of the distribution of this species in Nova Scotia (JWEL 1999) supports the contention that this species is not as rare as previously thought and is widely distributed. The study found four-toed salamanders in more than half of the sites searched and increased the number of recorded nesting sites in Nova Scotia from 20 to 45. The study also found that four-toed salamanders used a variety of sites as nesting habitat including anthropogenically created or modified sites such as roadside ditches and ponds, wheel ruts and quarry ponds. The critical requirements for this species are the presence of sphagnum moss in which to lay eggs and a semi-permanent or permanent, soft bottomed pond or slow flowing stream adjacent to the sphagnum moss in which the hatched larvae can develop.

No four-toed salamanders were encountered in the study area during the field surveys; however, suitable four-toed salamander breeding habitat was found in Wetland 1 (Figure 6.3) outside of the footprint of the LNG terminal. Four-toed salamanders have been found within approximately 7 km of the study area (JWEL 1999) and it is likely that they are present within the general study area. The marginal nature of the habitat present at Wetland 1 would suggest that the area does not support large numbers of four-toed salamanders.

6.1.9.4 Birds

Terminal Site

Information on the distribution and abundance of birds in the vicinity of the proposed terminal has been obtained mainly through: the Maritimes Breeding Bird Atlas (MBBA) database (Erskine, 1992); a review of the Atlantic Canada Conservation Data Centre data base (ACCDC 2003); a breeding bird survey conducted in the study area on June 23, 2003; and supplemental bird surveys conducted on April 14 and July 27, 2003. The breeding bird atlas data is of limited usefulness because that data is recorded in 10 km X 10 km census squares, making it impossible to establish whether a particular species has been observed in close proximity to the study area. Nevertheless, it does provide an indication as to which species may be expected in the study area. Should any rare or sensitive bird species be recorded

in the atlas square, field surveys may be focussed on the preferred habitat of these species to increase the efficiency of the field survey.

The breeding bird survey was conducted within the footprint of the proposed Project as well as within a 500 m wide buffer zone surrounding the Project footprint. This area was walked by an experienced birder and all birds observed or heard singing within the study area were listed and the numbers of each species in each habitat present in the study area were recorded. Bird data were collected on April 14, June 23 and July 27, 2003. The breeding bird survey began at 5:00 AM and was completed by 11:30 AM.

The breeding status of each species was determined using the criteria used in the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). Species identified but not exhibiting signs of breeding activity were classed as non-breeders. Species observed or heard singing in suitable nesting habitat were classified as possible breeders. Species exhibiting the following behaviours were classed as probable breeders:

- courtship behaviour between a male and female;
- birds visiting a probable nest site;
- birds displaying agitated behaviour; and
- male and female observed together in suitable nesting habitat.

Species were confirmed as breeding if any of the following items or activities were observed:

- nest building or adults carrying nesting material;
- distraction display or injury feigning;
- recently fledged young;
- occupied nest located; and
- adult observed carrying food or fecal sac for young.

The population status of each species was determined from existing literature. Lists of provincially rare or sensitive birds were derived from Atlantic Canada Conservation Data Centre (ACCDC 2003) and Nova Scotia Department of Natural Resources (NSDNR 2003a) while nationally rare or endangered species were derived from the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2003). A list of birds protected under the *Endangered Species Act* in Nova Scotia was derived from NSDNR (2003b).

Table 1 in Appendix H presents a list of bird species recorded within the atlas square within which the study area is situated. Table 2 in Appendix H presents the list of birds recorded in the study area during the field surveys along with their breeding status and overall abundance. Table 3 in Appendix H presents the numbers of each species recorded in the various habitat types present in the study area.

Rare and Sensitive Birds

A total of 83 species of bird have been recorded in the 10 km X 10 km atlas square. These include six species that are considered to be uncommon, rare or sensitive to anthropogenic activities. Three of the species are listed as yellow species, indicating that they are sensitive to anthropogenic activities (NSDNR 2003a). These include Common Loon, Common Tern and Northern Goshawk. Common Loons are relatively common in Nova Scotia but are sensitive to a variety of human activities, particularly around their breeding sites. Loons are sensitive to disturbance at their nest sites and their nests, which are located close to the edge of the water, and can be swamped by the wakes of motor boats or by water level fluctuations in reservoirs. Common Loons are also susceptible to ingestion of lead in fishing sinkers, accumulation of mercury in freshwater fish and loss or reduction in food supplies as a result of acidification of the freshwater bodies on which they live during the breeding season. Common Loons nest on lakes, generally on small islands where their nests are safe from predators. Adult loons along with their fledged young move to the coast in mid-September and remain in ice-free coastal waters until the lakes are ice-free in the spring. Immature birds and a few non-breeding adults remain in coastal waters throughout the year. No suitable nesting habitat is present within the study area so it is highly unlikely that this species breeds there. One immature Common Loon was observed in the Strait of Canso during the June 23 survey. Loons were not observed during the other surveys. Aggregations of up to 15 loons were observed on the Strait of Canso approximately 10 km northwest of the study area during the April 14 survey. It is likely that concentrations of loons occur regularly in the Strait during spring and fall migration. The area adjacent to the proposed terminal site does not appear to be commonly used by Common Loons.

Common Tern populations in Nova Scotia are adversely affected by disturbance at nesting colonies, predation of eggs and young by gulls and loss of prime nesting sites to gulls which typically begin nesting earlier than terns. Common Terns generally nest on coastal islands, sand spits, beaches and occasionally salt marshes. The study area contains only marginal Common Tern breeding habitat and no evidence of tern nesting was recorded during the June and July surveys in the breeding season. Two tern-nesting colonies are known from the general area. One is found on Scanlans Island approximately 10 km northeast of the study area (ACCDC 2003). This colony contained 55 nests in 1999. The other is located on a small island on Long Pond, a barrachois pond located on the Strait of Canso approximately 15 km northwest of the study area (JWEL 1991). This colony contained 15 to 25 nests in 1991. Several terns were observed on the Strait of Canso during the June 23 and July 27 surveys. These were adult terns that were probably foraging to feed young at one of the colony sites. The largest number of terns observed at any one time was two birds suggesting that Common Terns do not extensively use the coastal waters adjacent to the terminal site.

Northern Goshawks are threatened by disturbance during the nesting season and loss of suitable forest nesting habitat. Northern Goshawks typically nest in mature hardwood or mixedwood forests remote

from human activity. Although this species was recorded in the atlas square, it was not recorded during any of the field surveys. Some suitable nesting habitat is present in the central section of the study area.

Three species considered to be uncommon in Nova Scotia (ACCDC 2003) were recorded in the atlas square including Black-backed Woodpecker, Boreal Chickadee and Rusty Blackbird. The Nova Scotia populations of all of these species are considered to be secure (NSDNR 2003a). Black-backed Woodpeckers are generally associated with coniferous forest. They usually nest in mature softwood stands but are sometimes found nesting in islands of softwood forest in clear-cuts. Black-backed Woodpeckers are attracted to dead or dying coniferous trees. They typically pry off the bark of these trees while foraging for insects. Their feeding activities leave characteristic piles of bark scraps that can be used to establish their presence in an area. This sign was not observed during the field surveys nor was this species observed or heard during the surveys.

Boreal Chickadees are also associated with coniferous forests. This species is a cavity nester that often nests in cavities in relatively small trees. Although Boreal Chickadees are fairly common, the results of the breeding bird atlas program suggests that their numbers have decreased in recent years probably as a result of heavy harvesting of coniferous forests. Suitable nesting habitat for Boreal Chickadees was present throughout much of the study area. This species was recorded in the atlas square and in the study area during the June survey and can be expected to nest in the study area.

Rusty Blackbirds are typically associated with swamps along sluggish streams or stillwaters. They are most abundant in the interior of the province and are generally found in areas remote from human settlement. Only one of the five wetlands located on the Project property contained typical Rusty Blackbird Habitat. This wetland was visited on all three survey dates but no Rusty Blackbirds were found.

Raptors

Five raptor species have been recorded in the atlas square within which the study area is located. These include Osprey, Bald Eagle, Northern Harrier, Northern Goshawk, and American Kestrel. Only two of these species, Osprey and Bald Eagle were observed during the surveys. One Bald Eagle was observed flying over the study area during the June survey and two Osprey were observed flying over the study area during the July survey. No evidence of nesting was recorded for either species. They were probably foraging along the shore of the Strait of Canso.

Coastal Approach Route

Information regarding the use of the coastal approach route by birds was derived from Lock *et al*. (1994) and Brown *et al*. (1975).

Seabirds

Seabirds found in the study area include neritic seabirds and pelagic seabirds. Neritic seabirds are those species that spend most of their time in coastal waters and occasionally forage in inland areas. These include cormorants, gulls, terns and black Guillemots. Pelagic seabirds are typically found out of sight of land and return to coastal waters only to breed. These include storm petrels, auks such as Dovekies, puffins and murres, shearwaters and pelagic gulls such as the Black Kittiwake. Most seabird species breed in colonies, usually on islands or cliffs. They are most vulnerable at these colonial breeding sites.

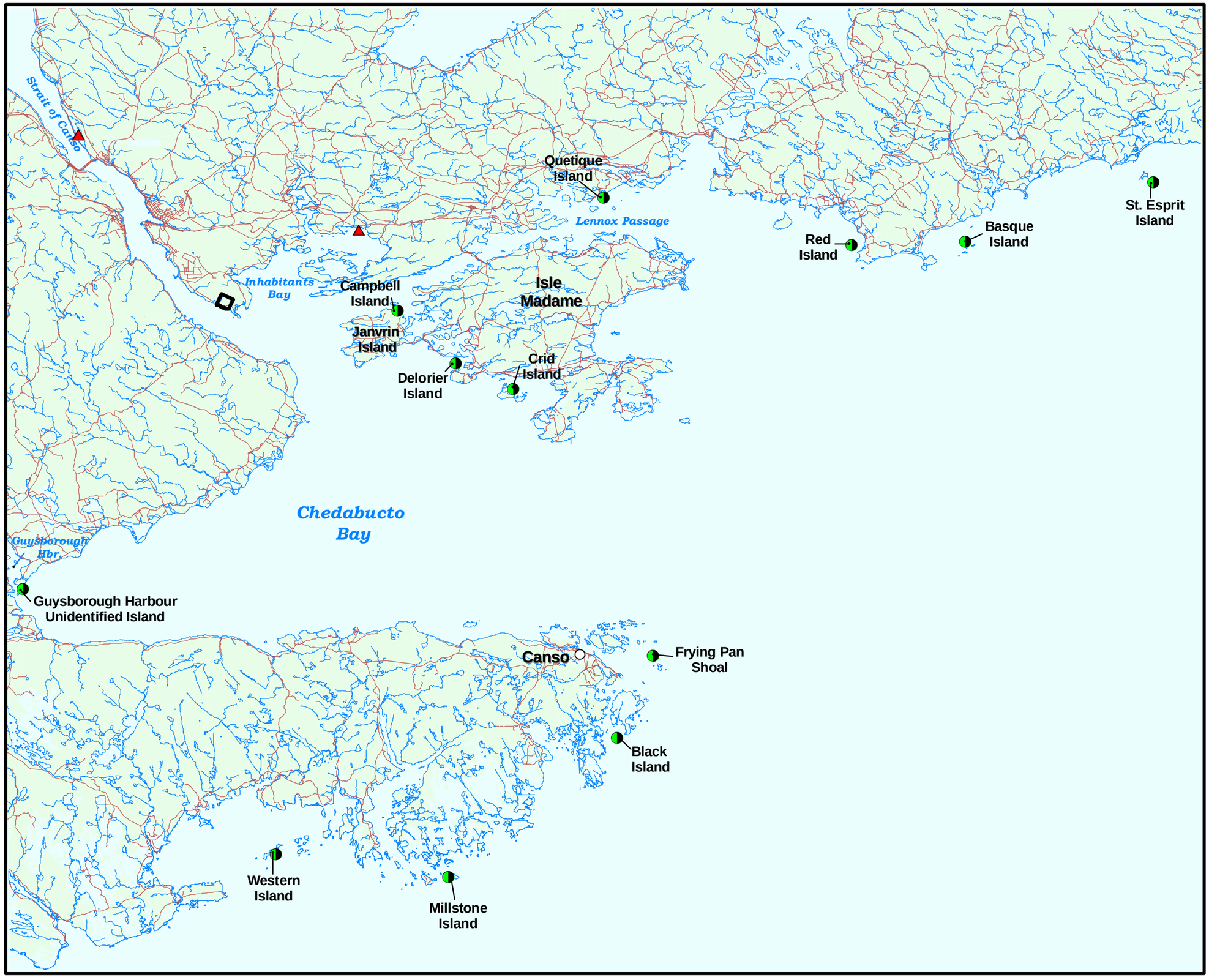
Three species of neritic seabird, Common Tern, Double-crested Cormorant and Great Cormorant, have been recorded as nesting in the general vicinity of the terminal site and the marine approaches to the terminal (Chedabucto Bay and Strait of Canso). Herring Gull and Great Black-backed Gull nest at variety of locations within the study area, particularly along the south shore of Chedabucto Bay (Erskine 1992). No data regarding colony locations and abundance is available for gull species for this area. Black Guillemots have not been recorded as breeding in the study area.

The distribution and abundance of Common Tern in the area has been discussed above. Cormorant colonies are present on 12 islands within the nearshore study area (Table 6.25 and Figure 6.9). Ten of these islands contain Double-crested Cormorant colonies and three contain Great Cormorant colonies. Both species are present on Red Island, the largest cormorant colony in the area. In 1987, 3,747 breeding pairs of Double-crested Cormorants and 611 breeding pairs of Great Cormorants were present in these colonies. These represent 23 % of the Double-crested Cormorant breeding population and 15 % of the Great Cormorant population in Nova Scotia. The two tern colonies present in the study area represent approximately 1 % of the Nova Scotia breeding population.

Table 6.25 Colonial Seabird Colony Sites Adjacent to the Coastal Approach Route

Location	Number of Breeding Pairs		
	Double-crested Cormorant	Great Cormorant	Total
Quetique Island	53		53
St. Esprit Island		197	197
Red Island	925	163	1088
Basque Island		251	251
Campbell Island	543		543
Delorier Island	768		768
Crid Island	16		16
Unnamed Island in Guysborough Harbour	55		55
Frying Pan Shoal	274		274
Black Island	193		193
Western Island	773		773
Millstone Island	147		147
Total	3,747	611	4,358

Source: Adapted from Lock *et al.* 1994



BEAR HEAD LNG TERMINAL

Figure 6.9

Seabird Colonies

Legend

- Tern Colony
- Cormorant Colony
- Roads
- Rivers
- ANE Property Boundary

N

0 3 6 9 12 15

Kilometres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Datum: NAD83
Zone: 20
Scale: 1 : 250,000
Project Number: NSD17393
Date: April 19, 2004

Source: Adapted from Lock et al. 1994

Jacques Whitford

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Only one species of pelagic seabird, Leach's Storm-petrel, is known to breed in the study area. A Leach's Storm-petrel colony is located in the vicinity of Canso (Erskine 1992). The number of storm-petrels breeding at this site is not known.

The relative abundance of seabird species varies over the course of the year in response to the natural history attributes of the species that use the area. The study area is located in near shore waters and contains few pelagic seabird colonies, consequently; most of the birds present in it are likely to be neritic seabirds. Pelagic seabirds would occur regularly near the mouth of Chedabucto Bay although incursions of pelagic seabirds may occur during storm events.

Gulls are present year round but are most abundant during the summer months when they are at their coastal breeding colonies, particularly in late summer when their chicks fledge. Terns are also most abundant in the summer near their breeding colonies. Terns typically arrive in May and leave in September. They are not present during the rest of the year. Double-crested Cormorants are similar in their temporal distribution. They arrive in early April and leave in October. Great Cormorants are present year round although their distribution around the province changes over the course of the year. During the summer Great Cormorants are found near their breeding colonies which are mostly on Cape Breton Island. During the fall and winter their distribution shifts to the south and they can be found throughout the province. In the study area, Great Cormorants can be expected to be most abundant during the summer months.

Leach's Storm-petrel is the only pelagic seabird which breeds in the study area. Leach's Storm-petrels arrive in Nova Scotia waters in early April and remain until early November. Several common pelagic seabirds migrate through the area and may be found near the mouth of Chedabucto Bay at various times during the year. Greater Shearwaters and Sooty Shearwaters arrive in Nova Scotia waters in late May. The Sooty Shearwaters leave in September while the Greater Shearwaters remain until November. Wilson's Storm-petrels are present from April to October with peak numbers occurring between June and August. These three species breed in the south Atlantic and spend the austral winter in the Northern Hemisphere.

Northern Gannets migrate along the Atlantic coast of Nova Scotia during the spring and fall on their way to their breeding colonies in the Gulf of St. Lawrence. In the spring they typically arrive in March and peak movements occur during the period from mid-April to mid-May. Fall migration begins in early September and reaches its peak in between mid-October and early November. A few nonbreeding juveniles are present throughout the summer.

Auk species including Common Murre, Thick-billed Murre, Razorbill, Atlantic Puffin and Dovekie generally breed north of Nova Scotia and spend the winter on the continental shelf off Newfoundland and Nova Scotia. Several small colonies of Razorbill and Atlantic Puffin are present in Nova Scotia; however, none of these colonies are located near the study area. Murres are present from early

December to April and Dovekies are generally present from November to April. Transient razorbills are generally seen from mid-October to mid-May. Transient Atlantic Puffins are most frequently present in the waters off Nova Scotia during the fall between October and December.

Coastal Waterfowl and Divers

A variety of sea duck, loon and grebe species occur regularly in the study area. Most of these species breed in freshwater habitats and spend the fall, winter and early spring in coastal waters. They occur most frequently in Nova Scotia during spring and fall migration. The species most frequently encountered include Common Eider, Black Scoter, White-winged Scoter, Surf Scoter, Red-breasted Merganser, Long-tailed Duck, Common Golden-eye, Common Loon, Horned Grebe, and Red-necked Grebe. Dabbling ducks such as American Black Duck are also present in relatively large numbers but are largely restricted to shallow sheltered waters such as those found in salt marshes, barrachois ponds and sheltered coves.

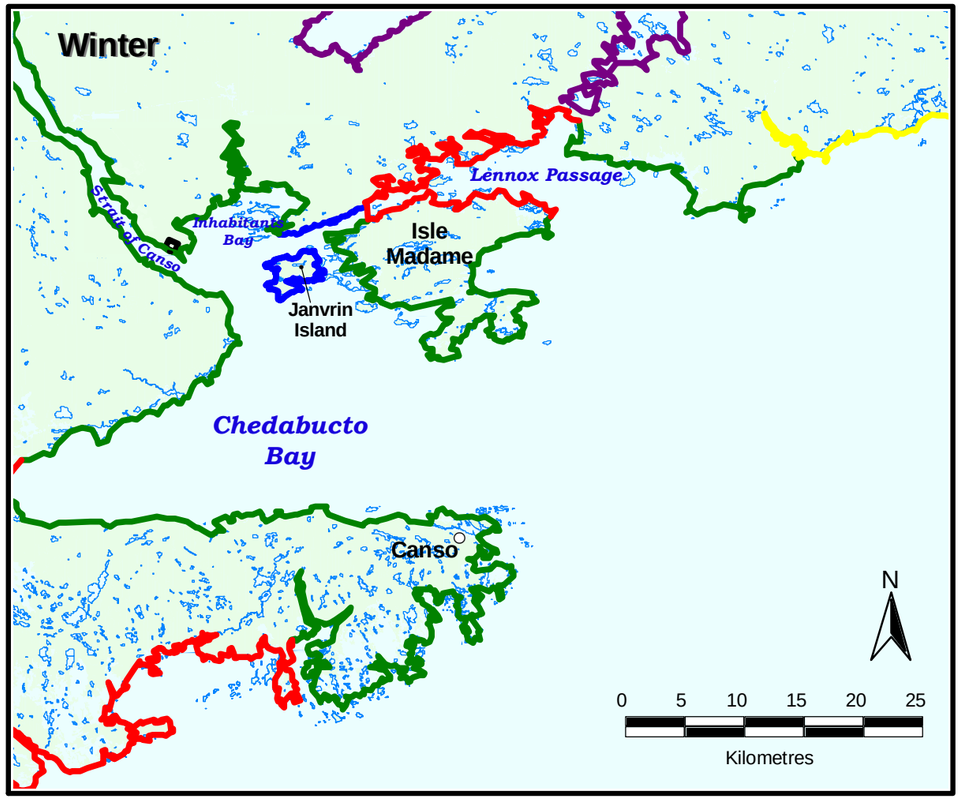
The number of coastal waterfowl present in the study area varies seasonally with the largest number of waterfowl present during spring migration and the lowest numbers present during the summer months. The distribution of sea ducks in the study area (Lock et al. 1994) also varies seasonally and is described in Figure 6.10 and the following text.

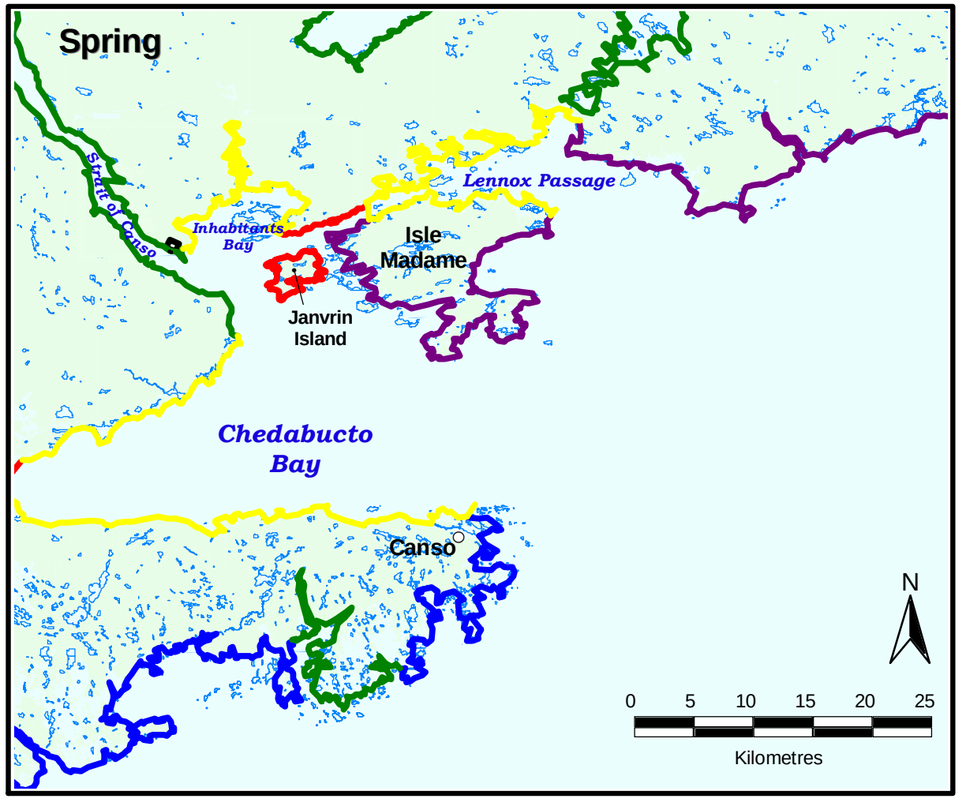
Winter

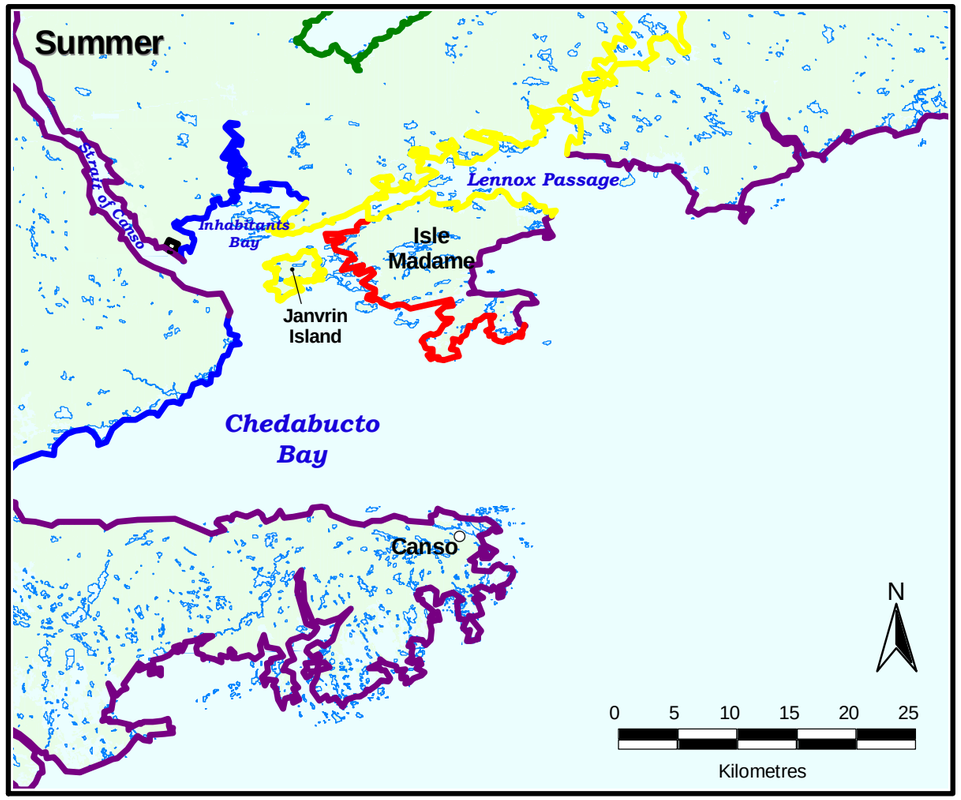
During the winter months the Strait of Canso and Chedabucto Bay support low concentrations of coastal waterfowl (0.06 to 1.99 birds/km). Moderately high concentrations (2.00 to 4.99 birds/km) are found to the north of Isle Madame and relatively high numbers are found around Janvrin Island (7.5 to 66.1 birds/km).

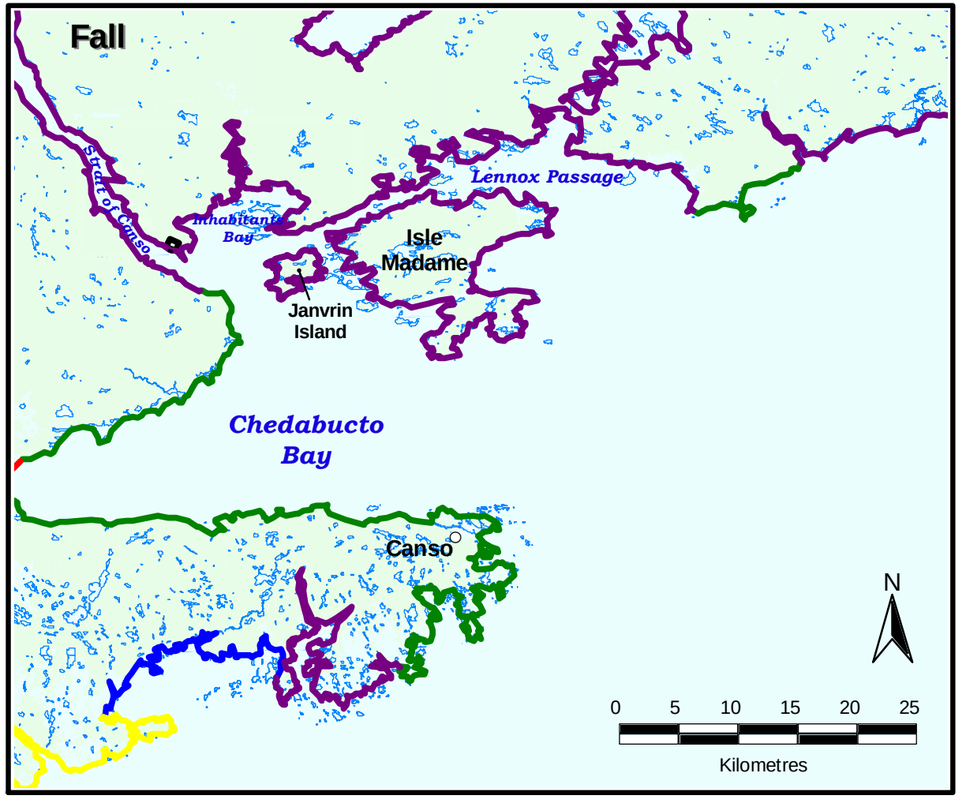
Spring

The heaviest concentrations of coastal waterfowl are found in the study area during spring migration. The highest concentrations are found in the vicinity of Canso at the mouth of Chedabucto Bay (12 to 51 birds/km). Relatively high numbers are also found in Inhabitants Bay, Lennox Passage and around most of Chedabucto Bay (2.5 to 12.0 birds/km). Moderately high numbers (0.5 to 2.5 birds/km) are found around Janvrin Island and at the mouth of Guysborough Harbour. Low numbers of coastal waterfowl (0.03 to 0.5 birds/km) are found in the Strait of Canso during the spring.









BEAR HEAD LNG TERMINAL

Figure 6.10
Coastal Waterfowl

Legend

Winter (Waterfowl/km)
- 7.50 to 66.06
- 5.00 to 7.49
- 2.00 to 4.99
- 0.06 to 1.99
- unsurveyed

Spring (Waterfowl/km)
- 12.00 to 51.06
- 2.50 to 11.99
- 0.50 to 2.49
- 0.03 to 0.49
- unsurveyed

Summer (Waterfowl/km)
- 1.00 to 17.23
- 0.50 to 0.99
- 0.05 to 0.49
- 0.025 to 0.04
- unsurveyed

Fall (Waterfowl/km)
- 4.00 to 133.7
- 2.00 to 3.99
- 1.00 to 1.99
- 0.03 to 0.99
- unsurveyed

ANE Property Boundary

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Datum: NAD83
Zone: 20
Scale: 1 : 500,000
Project Number: NSD17393
Date: April 19, 2004

Source: Lock et al. 1994

Jacques Whitford

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Summer

There is relatively little coastal waterfowl distribution data for Nova Scotia during the summer months however; most of the study area with the exception of the Strait of Canso and the southern shore of Chedabucto Bay has been surveyed. The highest concentrations of coastal waterfowl (1.0 to 17.2 birds/km) are found along the north shore of Chedabucto Bay and Inhabitants Bay. Relatively high numbers (0.5 to 1.0 birds/km) are found around Janvrin Island and Lennox Passage. Moderate concentrations (0.05 to 0.5 birds/km) are found on the southern shore of Isle Madame.

Fall

Fall coastal waterfowl distribution data for the study area is available only for Chedabucto Bay. Numbers in this area are low (0.03 to 1.0 birds/km) except at the mouth of Guysborough Harbour where moderate numbers (1.0 to 2.0 birds/km) are present.

Common Eider is the only species of coastal waterfowl expected to breed in any numbers in the study area. This species differs from other sea ducks and divers in that they typically nest on wooded coastal islands rather than freshwater habitats. The study area supports relatively few breeding eiders. Chedabucto Bay has an estimated 116 breeding pairs while the area around the Strait of Canso, Isle Madame and Lennox Passage supports 43 nesting pairs. The largest concentrations of nesting eiders are found in the vicinity of the Eastern Shore Wildlife Management Area (3,178 nesting pairs) well to the south of the study area. The eider breeding population in the study area represents approximately 2 % of the eider breeding population in Nova Scotia.

6.1.9.5 Rare Plants

A review of the existing literature, combined with two field surveys, was used to determine if any nationally (COSEWIC 2003) or provincially (NSDNR 2003b; Pronych and Wilson, 1993) rare plant species were present within the Project footprint and nearby wetlands.

The existing literature (ACCDC 2003; Pronych and Wilson 1993; Jacques Whitford 2003; Jacques Whitford 2000) indicated that while no rare lichen or bryophyte species have been recorded in the area, seven rare vascular species had been recorded in the general vicinity of the study area. Suitable habitat was present for four of these species, blinks, Hooker's orchid, northern commandra and yellow lady's-slipper. The field surveys revealed the presence of 247 species that are listed in Table 4 Appendix H. Two of these species, southern twayblade (*Listera australis*) and northern commandra, are considered to be rare.

Southern twayblade is considered to be rare throughout Canada with less than 20 records for the country. It is listed as rare in Ontario and Quebec and very rate in New Brunswick and Nova Scotia. It is not listed under SARA (COSEWIC 2003) or under the Nova Scotia Endangered Species Act (NSDNR 2004). Southern twayblade is a red listed species in Nova Scotia (NSDNR 2003b) indicating that the Nova Scotia population is considered to be at risk. Four southern twayblade were found in an open coniferous treed swamp dominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*) near the western bank of a Stream A, on the western side of the study area (Figure 6.2). The southern twayblade was found in association with sedge (*Carex stricta*) and sphagnum moss (*Sphagnum* spp.).

Northern commandra was found in the same general area as southern twayblade (Figure 6.3). This species is yellow listed by NSDNR indicating that the Nova Scotia population is considered to be sensitive to anthropogenic activities or natural perturbations. A total of five patches of northern commandra were found in the study area. The number of stems per patch ranged from 12 to approximately 200 with a total of approximately 480 stems. The total number of plants present in this population could not be determined since this species is rhizomatous and many of the stems observed during the survey are likely to be part of the same plant. Northern commandra was mainly associated with small openings in stunted black spruce woodland. It was generally found on dry sites but some stems were also found at the edge of a small basin bog (Wetland 4).

The Atlas of Rare Vascular Plants in Nova Scotia (Pronych and Wilson 1993) was reviewed to determine which rare plant species might be present in the study area. All species found within the 10 km by 10 km atlas square within which the study area is located as well as all eight atlas squares bordering this atlas square were noted. Additional information regarding the presence of rare vascular plants in the general vicinity of the study area was derived from previous rare plant surveys conducted in the area and data collected by the Atlantic Canada Conservation Data Centre (ACCDC 2003). Table 6.26 lists the species found in these squares along with the phenology of each species, the ease with which it can be identified, preferred habitat, and provincial population status. Seven species were identified as being potentially present in the study area including maidenhair spleenwort, yellow lady's-slipper, fragrant wood fern, false mermaid, blinks, Hooker's orchid and northern commandra. A review of the habitats present in the study area indicated that four species, yellow lady's-slipper, blinks, Hooker's orchid and northern commandra were likely to be present in the study area. There are no cliffs or rich forests in the study area so the probability of encountering maidenhair spleenwort, fragrant wood fern or false mermaid was low. The probability of encountering yellow lady's-slipper was also relatively low; however, the field botanist has encountered this species in swamps in similar habitat nearby so it was not eliminated from the list of potential species. Blinks, Hooker's orchid, northern commandra and yellow lady's-slipper flower in June; consequently, a rare plant survey was conducted on June 23 to detect these species as well as other early flowering species. A second rare plant survey was conducted on July 27 to detect later flowering species.

Table 6.26 Phenology and Habitat Preferences of Rare Vascular Plant Species Found in the General Vicinity of the Study Area			
Species	**Flowering Period/ Ease of Identification**	**Preferred Habitat**	**NSDNR Status**
Asplenium trichomanes (Maidenhair Spleenwort)	Readily identified using vegetative characteristics	Damp shaded cliffs and talus slopes on acidic rocks.	Green
Cypripedium calceolus (Yellow Lady's-slipper)	June 1 to 20. Can be identified using foliage and fruit.	On calcareous soils, often near gypsum or limestone outcrops. Occasionally in deciduous forests or minerotrophic wetlands.	Yellow
Dryopteris fragrans (Fragrant Wood Fern)	Spores present June to September. Readily identified by vegetative characteristics.	Dry, overhanging cliffs, and in cliff crevices along streams or near waterfalls.	Yellow
Floerka proserpinacoides (False Mermaid)	Late May to late June. Can be identified relatively easily from vegetative characteristics.	Deciduous ravine slopes, river margins, and intervale forests.	Yellow
Geocaulon lividum (Northern Commandra)	Late May to early August. Readily identified during the growing season by its distinctive coloration.	Sterile soils and damp sands in acid or peaty locations.	Yellow
Montia fontana (Blinks)	June to September	Springy or seepy slopes, wet shores and brackish spots	Yellow
Platanthera hookeri (Hooker's Orchid)	May to August. Distinctive based leaves can be used for identification.	Mixed woods, frequently under conifers. Prefers open, dry conditions.	Green

6.2 Socio-economic Environment

6.2.1 Archaeological and Heritage Resources

The assessment of heritage resource potential within the study area incorporated a number of sources: archaeological site records at the Nova Scotia Museum; historic literature and archival resources; and an archaeological survey of the proposed Project area.

6.2.1.1 Background Research

Background research, with an emphasis on historic maps, was conducted at the Public Archives of Nova Scotia. The most useful map was one of Richmond County compiled by A.F. Church and published between 1883 and 1887. This map shows moderate settlement along the road that leads to Bear Cove, as well as the circular road that skirts the cove to the north. These settlements are related to mining activities in the area during the nineteenth century. A scanned portion of this map was geocorrected using ArcView Image Analysis software and the locations of the dwellings on the Church map (A.F. Church 1883-1887) were digitized as point files (Figures 1 and 2, Appendix I). These files were then overlain on a digital basemap and a geocorrected aerial photograph (Figures 3 and 4 Appendix I). This showed that there were seven potential dwellings/features located within the study area, most likely

dating from the middle to the last quarter of the nineteenth century. Each dwelling on the Church map had a name attached to it as follows:

- G. Wright;
- McPherson;
- T. Mitchell;
- P. Mackie;
- J. Mackie;
- D. O'Brien; and
- J. Morash.

Because the A.F. Church map was geocorrected, each potential dwelling also had real geographic coordinates, and these were programmed into a hand-held GPS for use during the field survey (Figure 6.11).

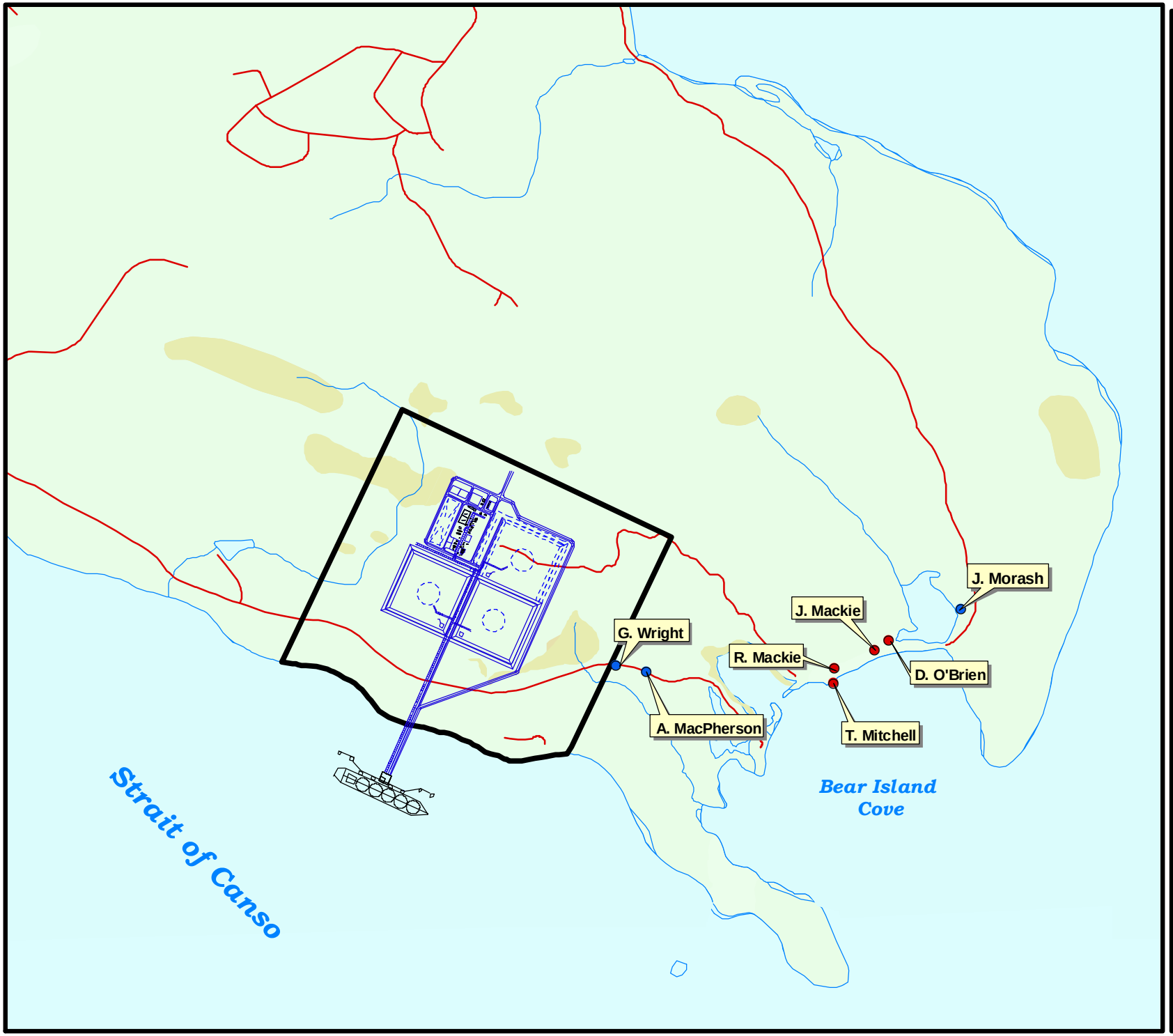
The Nova Scotia Museum's Archaeological Sites Inventory Database was also checked but there were no reported archaeological sites of any type within the study area (S. Powell pers. comm. 2003).

Archaeological Potential – Pre-Contact

While there are no reported pre-Contact (*i.e.*, prior to European settlement) archaeological sites within the study area, it should be noted that this region has not been the subject of any scholarly archaeological study from which settlement patterns have been derived. However, there appear to be very few resources that would have attracted settlement prior to European contact. This area is very exposed and would likely have been less attractive compared to a site further inland. There may have been some potential for the exploitation of larger marine mammals offshore (particularly from Bear Cove), and bear, moose and deer inshore; however, there are no major water systems within the study area that would have provided the drinking water, food, and transportation to inland resources necessary for sustained settlement. It is considered that there is a low to moderate potential of the study area containing pre-Contact archaeological resources, with an elevated potential along the eastern shore.

Archaeological Potential – Historic

The A. F. Church map suggests that there is a high potential of the study area containing historic archaeological resources dating after the mid-nineteenth century. There are seven potential sites shown on the Church map that fall within the study area (Figure 6.11). However, there is a low potential for historic resources dating earlier than the mid-nineteenth century.



BEAR HEAD LNG TERMINAL

Figure 6.11

Archeological Sites

Legend

- Archeological Sites for which building remains were located
- Archeological Sites for which building remains were not located.
- ANE Property Boundary
- Rivers & Streams
- Roads
- Wetlands
- Lakes

N

100 200 300 400 500

Metres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Datum: NAD83
Zone: 20
Scale: 1 : 15,000
Project Number: NSD17393
Date: April 19 2004

Jacques Whitford

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6.2.1.2 Field Survey

A field survey of the study area was conducted during the week of September 15 to 19, 2004. The fieldwork consisted of a pedestrian survey along the coastline of the study area with particular emphasis on the moderate potential for Aboriginal resources along the east coast. A GPS-based search for settlement features indicated on the digitized A.F. Church map was also carried out.

The locational data gathered from the digitizing of the A.F. Church map was entered into a hand-held GPS unit as waypoints. In the field, a pedestrian survey was conducted in an attempt to relocate these waypoints and their associated features. In addition to this method of surveying, a pedestrian survey was also conducted along the length of the shoreline and into any other areas deemed as having archaeological potential. Any features that were identified were photographed using a digital camera and the relevant information was recorded on a Maritime Archaeological Resource Inventory Site Survey Form.

Survey

The pedestrian survey began with a search along the shoreline of the study area. The south-western shore consists of a cobble beach edged by small, eroding cliffs (Photos 1 and 2 Appendix I). The water along this shore appears to drop off very sharply and would have provided a deep anchorage, although almost completely exposed. The only settlement feature located along this shore was a spoil heap of rocks, presumably from mining activity of some sort (Photo 5 Appendix I). A more intensive survey was carried out in the area around this feature but nothing else of note was observed.

At the tip of Bear Head, the survey moved to the inland portion of the south-western shore. This area is moderately forested with a mix of softwood and hardwoods. The terrain slopes gently to the north. The survey continued back to the northwest but no settlement features were encountered, although there is a large, area quite recently cleared by Nova Scotia Community College (NSCC) forestry program students at the west end of the study area.

From this point the survey proceeded to Bear Cove at the end of the Bear Head road. The Church map indicates two houses along the Bear Cove road, G. Wright and A. MacPherson. Each point was relocated using the GPS and a survey was conducted in each area, extending to a buffer approximately 50 m on all sides of the points; no settlement features such as cellars were observed. These resources may have been destroyed when the land was purchased by the Province from property owners to allow for the establishment of the industrial park.

The cove has a rocky barrier beach, which has been breached, and, while still exposed to the ocean, it offers some protection (Photo 6 Appendix I). There is a large pond behind the beach that drains almost completely at low tide (Photo 7 Appendix I) and a large marsh to the west of the road's end (Photo 8

Appendix I). A survey was conducted along the southern edge of this shoreline, with a particular emphasis on checking any eroding banks for evidence of past Aboriginal occupation. No evidence of Aboriginal or historic occupation was found in this area.

The survey moved along the barrier beach to the south-east end of the survey area. This area of the cove has a relatively flat, rocky beach and an open, level area just above the beach (Photos 9, 10, and 11 Appendix I). There were five houses shown by the A.F. Church map to be in the area (J. Mackie, R. Mackie, T. Mitchell, D. O'Brien, and J. Morash) (Figure 5 Appendix I). The waypoints for each dwelling were followed using the GPS and each cellar was located within or adjacent to the open field above the beach. The results of the search for each cellar are summarized below.

D. O'Brien

This is the most easterly foundation located within the study area. It is approximately 20 m north of the beach (Photo 12; Figure 6 Appendix I). This cellar measures 4.5 by 5.5 m, and is constructed from dry-laid fieldstones. There is no root cellar, owing no doubt to the difficulty in digging into the old beach. The foundation is completely covered by choke cherries. There is a fieldstone wall running east from the south-east corner for approximately 9 m. To the north of the wall is some rock collapse covered by raspberry bushes. The function of this wall or extension was unclear. This cellar is located approximately 49.5 m east of the J. Mackie dwelling.

J. Mackie

This foundation is also located in the open field, about 30 m north of the beach (Photo 13, Figure 7 Appendix I). The foundation is much more modern looking, with flat, dressed stones mortared together, and measures 7.3 m by 6 m. The interior of the dwelling is completely covered by choke cherries, but a large rock mound on the west wall is no doubt the remains of an interior chimney/fireplace. There is also a small root cellar in the north-east corner, which measures .70 by 1 m and is roughly 1 m deep.

R. Mackie

This cellar is shown on the Church map as being more inland than the others and it was found on the wooded fringe, in a more elevated position than the others, about 65 m north of the beach. The fieldstone cellar measures 4.5 by 4 m and is 1.3 m deep (Photo 14, Figure 8 Appendix I). The exterior of the southern wall appears to have been artificially created into a small hillock. There is also a small, stone-lined well located in a field approximately 16.3 m south-west of the cellar.

T. Mitchell

The only apparent error with the data derived from the Church map involves the Mitchell dwelling. Church shows the house to be approximately 60 or 70 m north of the cove, but when this area was surveyed, no settlement features were found. However, a foundation was discovered on the point of

land on the east side of the barrier beach. This is most likely the Mitchell property and the Church location was a probably a mapping error.

The Mitchell foundation is dry-laid fieldstone with some evidence of brick being used. It measures approximately 5.3 by 5 m and is located roughly 5 m north of the eroding beach bank (Photos 15 and 16, Figure 9 Appendix I). The cellar is approximately 1 m deep.

J. Morash

This dwelling is shown on the Church map to be on the east end of Bear Cove beach, slightly inland on the edge of a large pond. For the most part, this area is low and wet and is covered by moss and dead trees. The area was searched from the beach north along the shore of the pond and approximately 30 m east of the pond. No evidence of a former dwelling was found. There was no observable modern activity that would have destroyed evidence of a dwelling, and the building may have been one without a substantial foundation or cellar, which has simply disappeared after abandonment.

Testing

The four foundations located during the survey were within the study area, but outside of the footprint of the Project, and should not be threatened. The historic background research, and the attributes of the cellars, indicate they date from the mid-nineteenth century and were occupied up to the twentieth century. Based on this information, it was concluded that shovel testing would not be necessary to obtain more certain dating of the sites.

As stated above, there were no areas identified as having a high potential for containing pre-Contact archaeological resources and, therefore, it was concluded that sub-surface testing was not necessary. However, eroding banks were examined for archaeological material.

6.2.2 Marine Navigation

The Sydney Marine Communications and Traffic Services (MCTS) Annual Statistics of Canso traffic information for vessels that have moved in the Canso Traffic Zone over a period of one-year is summarized in Table 6.27. A movement consists of a transit from one designated point to another designated point (*e.g.*, from the pilot boarding station to an anchorage and from the anchorage to a berth, are two separate movements). The total number of ships accessing the zone equals approximately half the number of moves. Canso Daily statistics include the movement of harbour tugs and vessels of less than 20 m length overall (LOA) which are at all times operating within the Canso Traffic Zone; these have been excluded from this summary.

Table 6.27 Number of Vessel Movements Within the Strait of Canso		
Month	**Year**	**Number of Vessel Movements**
October	2002	100
November	2002	126
December	2002	103
January	2003	130
February	2003	102
March	2003	133
April	2003	129
May	2003	151
June	2003	200
July	2003	204
August	2003	238
September	2003	175
Total over 12month period		**1,791**
Estimated Number of Ships Based on the Assumption of 2 Movements per Vessel		896
Source: Sydney MCTS Annual Statistics		

Typically, most vessel traffic occurs in the summer months with activity dropping off in late fall and winter.

Safety of Operations

The LNG vessels are controlled by inter-government, government and industry standards. The principles for the protection of the surrounding communities, the environment, and the site are based on: the physical and chemical properties of the LNG; the Codes, Standards and regulations; and the technology and operational controls that have evolved since the commencement of LNG transportation and storage. The safety and reliability of LNG vessels are described in detail in Section 3 and in Appendix C.

Marine Carriers

The Project is intended to receive 70 to 135 LNG vessels per year entering the Strait of Canso. This would increase the total number of movements to approximately 1,931 to 2,031 movements, an increase of 7.8 to 13.4%, respectively. This assumes that the LNG carriers will proceed directly to the berth and not anchor on arrival.

The Cape Breton Pilot advised that from January 1 to October 20, 2003, the pilots assisted the passage of 1,150 ships (indicating that the statistics in Table 6.27 are an underestimate of the number of ships travelling the Strait). Each pilot normally handles in excess of 250 assignments per year.

LNG carriers are designed to carry cryogenic liquids. LNG is carried at a temperature below - 163°C. The tanks in which the LNG is carried are supported in the hull of the vessel and no part of the tank is in contact with the water. The largest LNG carriers will be used to transport LNG to the terminal at Bear Head. LNG carriers are currently built or are to be delivered with approximate dimensions as outlined in Table 6.28.

Table 6.28 Dimensions of LNG Carriers

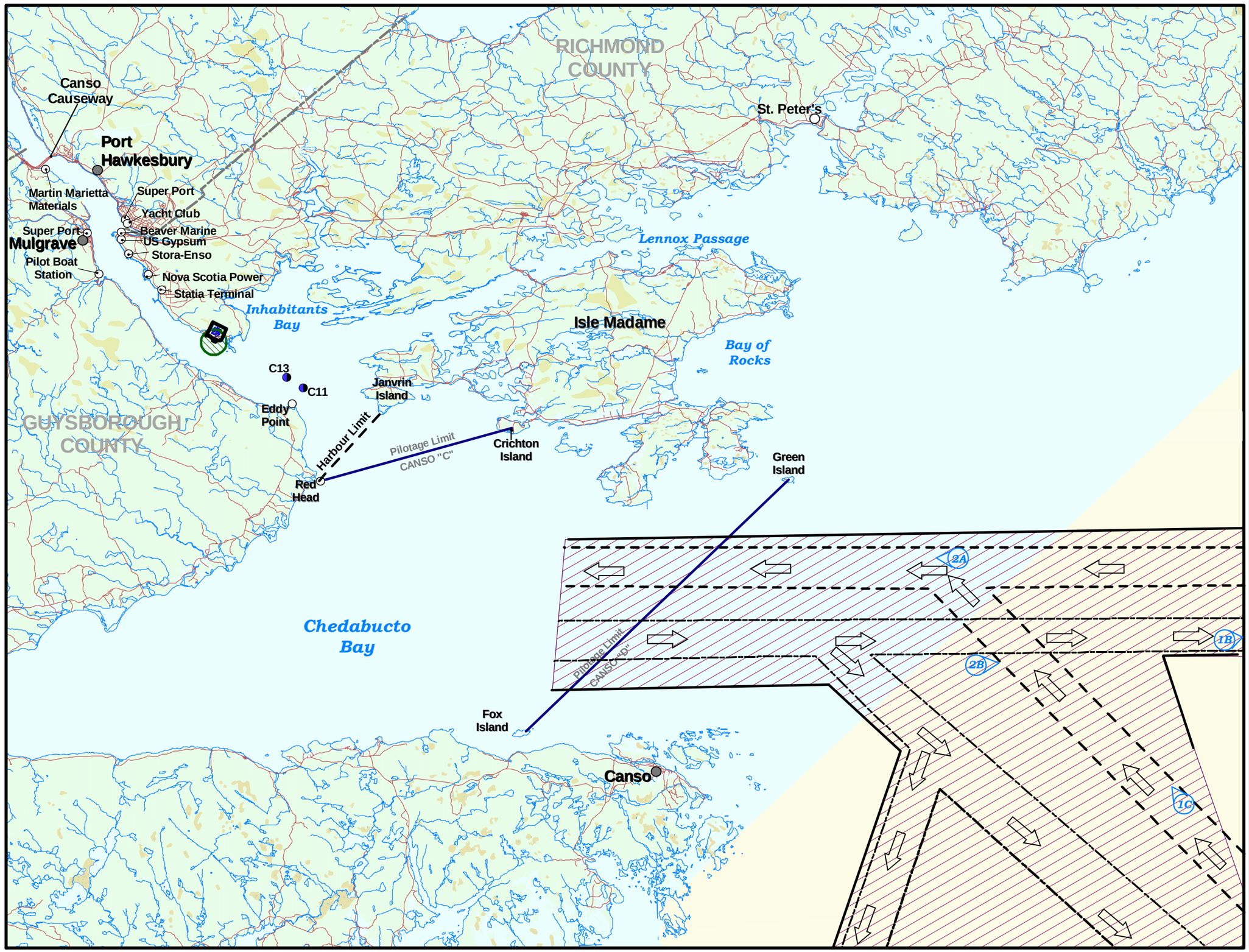
	Existing Ship Data
Length Overall (LOA)	281 m
Beam	45 m
Draught	12.1 m
Deadweight	79,000 tonnes
Liquid Capacity	143,000 m^3
Gross Tonnage	101,000
Speed at Sea	19.5 knots

6.2.2.1 Ocean Passage into Canadian Waters

All vessels arriving from deep sea enter Canadian Waters at the “12-mile limit”, the mean distance from the shoreline inside which Canadian Legislation takes precedence. Vessels are required to report in to MCTS Eastern Canada Vessel Traffic Services Zone Regulators (ECREG) (S. Creaser, pers. comm., 2003) 24 hours before arriving at the 12-mile limit. In most cases, this means that MCTS has information on the intended passage of vessels in excess of 200 miles from shore, the Exclusive Economic Zone (EEZ). Routing across the Atlantic will bring the vessels adjacent to the entrance of the Traffic Separation Scheme off Canso from different directions. The Scheme allows two lanes for entry, one at calling-in point '1A' for vessels entering from the east, and the other at '1C' for vessels entering from the South east (Figure 6.12). Approaching these points, the Canso-bound vessels will cross the tracks of vessels bound to and from other East Coast ports in both Canada and the USA, and vessels trading into the St. Lawrence. Navigation in these areas will be at full sea speed, unless reduced visibility or other condition deems it necessary to reduce.

Navigational Restrictions

The regulations and practices of the port will govern the movement of the LNG Vessels. Some jurisdictions place "Boating Safety zones" around LNG Carriers and require that additional safety precautions, such as accompanying tugs, are practiced when gas carriers are manoeuvring or berthed. All precautions will be reviewed and adopted or modified to support the safety of operations in the area.



BEAR HEAD LNG TERMINAL

Figure 6.12

Marine Navigation

Legend

- Buoys
- Outgoing Shipping Lanes
- Incoming Traffic Lanes
- Pilotage Lines
- ANE Berth Buffer (703 m)
- ANE Property Boundary
- Traffic Separation Scheme
- DND Exercise Areas
- Calling In Points

N

0 2 4 6 8 10

Kilometres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Datum: NAD83
Zone: 20
Scale: 1 : 200,000
Project Number: NSD17393
Date: April 19, 2004

** Note: These are approximate locations. This map should not be used for navigation. **

Jacques Whitford

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Pilotage Passage

Contacting Pilot

An incoming vessel is contacted by MCTS with instructions as to when the pilot will board, what speed to maintain, and on which side to make a lee for the pilot boat. A Cape Breton Pilot arrives at the pilot Boarding Station on the Atlantic Pilotage Authority (APA) pilot boat. The pilot boards the vessel and discusses the passage plan with the Master and the bridge team. A pilot's duties are to aid the Master and advise on the passage. In effect, the navigational command of the vessel, issuing helm and engine orders to the bridge team is assumed by the pilot. This in no way relieves the Master of his/her responsibilities.

Anchoring

If the berth is not available, the weather conditions are not suitable, or one of many other commercial conditions is not met, the vessel may be required to anchor. The pilot directs the vessel to the designated anchorage and drops the anchor. All anchorages in Chedabucto Bay have between 25 m and 44 m of water. It is normal to let out 270 m of cable which produces an effective swing circle with a radius of 550 m from the anchor position to the stern of the vessel. The pilots report that the anchorages are good holding ground, mainly clay. The pilot disembarks once the vessel is at anchor. A navigational bridge watch is maintained and the engines are ready to manoeuvre the vessel depending on the local conditions.

Inbound from Anchorage

The pilot boards at the anchorage. When the vessel departs the anchorage to approach the berth at the facility, it proceeds at manoeuvring speeds, and makes good a course close to or on the starboard side of the centre line of the channel. By the time the vessel is abeam of C11 buoy off Eddy Spit (Figure 6.12), it will be at reduced speed. The vessel will round buoy C13 (Figure 6.12) and begin its approach to the turning position and the terminal. Tugs are made fast. The vessel normally swings through 180 degrees off the berth or to the northwest of it. The recommended diameter for the swing circle is 2.5 times the length of the vessel. The width of the channel off the berth is 1,000 m, the design vessel is 281 m LOA, resulting in a required swing circle of 703 m. The channel width is well in excess of the 703 m required. The carrier will then berth bow out, port side alongside.

Berthing

The berthing arrangements will be finalized at the same time as the Operations Manuals are completed. Transport Canada identifies the need for manuals giving the port's and terminal's procedures for safe operation in the TERMPOL Review document. It will include all information that is either regulated or

set as a standard or condition of use for the harbour or the terminal. Tug size and numbers, speed of approach to the berth, telltale aids for berthing, mooring line arrangements, gangways, and services will be included in the TERMPOL Review document.

Calling in Points

Along the track, there are designated calling-in points. Vessels on passage in the Approaches and in the Strait of Canso must call in to MCTS giving details of their location, course, speed, and the estimated time to the next point. MCTS monitors the vessel on radar and advise the master/pilot of other traffic or if the vessel is not complying with the navigational protocol. The vessel also advises MCTS when to anchor.

Navigational Aids

The buoys, lights, range markers (beacons which when aligned show the centre line of the channel), and the electronic navigational aids ensure that the proposed passage is safe. Concern has been expressed that the removal of the Eddy Point Lighthouse brings safety of navigation below that which the Levels of Service Standards dictate. The Keepers of the Beacon Society (a community lighthouse preservation organization) expressed the concern that small vessels were unable to see the buoys in high seas, and that in 2002 the buoys 'C11' and 'C13' were removed and not replaced for three months. It is their contention that the Levels of Service Standards are not being adhered to, and that the process for deciding on the presence or absence of an aid is now a result of a risk management assessment. The Keepers of the Beacon Society state that if the light is replaced it will be serviced and maintained as a private light by the Society (G. MacQuarrie, pers. comm., 2003).

Outbound Passage

A Cape Breton Pilot boards the vessel at the berth. Tugs are employed while the vessel manoeuvres off the berth, until it is pointed and proceeding down channel. The outbound navigational process is the reverse of the inbound process. The pilot disembarks when the vessel is clear to proceed without the advice of the pilot.

MCTS 'Canso Traffic' continues to monitor the progress of the vessel and the vessel continues to report until it is clear of the VTS zone.

Navigational Restrictions in Pilotage Waters

In the area, prevailing winds are from the west. Winds of up to 65 knots from the north and northwest are reached. Berths in the Strait have some shelter from these winds and have experienced no difficulty

staying alongside (E.Dorey, pers. comm., 2003). Tidal currents seldom exceed 0.5 knots in the spring tide range and have little effect on manoeuvring, as currents tend to flow parallel to the land.

6.2.3 Fisheries and Aquaculture

6.2.3.1 Commercial Fishery

The fishery data analyzed in this section includes landings from 1998 to 2002 reported to DFO by license holders and observers. Observer data only covers approximately 10 to 20% of the domestic fleet, but more accurately reflects the locations of catch. The observer data is used only to compare fishing areas within the DFO unit. The DFO catch data lists multi-year landings (in weight) from 1998 to 2002 for DFO Unit Area 4Wd (Table 6.29). Catch data from 1998 to 2002 indicate that 37 commercial fish species with a total average annual catch of 4,924 tonnes were landed in Area 4Wd. The most significant fisheries in Area 4Wd are shrimp and snow crab. In 1998, the total catch from DFO Unit Area 4Wd was over 4,250 tonnes; in 2002, the catch decreased slightly to 4,090 tonnes. Table 6.30 provides information on the typical seasons of some of the fisheries conducted in Area 4Wd.

Table 6.29 Landings of Commercial Species in DFO Unit Area 4Wd (tonnes/yr)

Species	1998	1999	2000	2001	2002
Groundfish Landings					
Atlantic Halibut	2.01	0.09	0.56	3.12	1.57
Catfish	0.04	0.01	0.00	0.10	0.02
Cod	4.93	0.33	0.69	3.60	3.45
Cusk	0.74	0.27	0.01	0.14	
Dogfish		0.14			
Haddock	1.62	0.21	0.20	0.28	0.02
Monkfish	0.38	0.04	0.01	0.01	0.00
Plaice			0.30		0.76
Pollock	11.53	0.27	0.00	0.06	
Redfish	0.56			1.49	
Turbot	0.01	0.01		0.01	0.74
Unspecified Flounder	1.61	0.94	0.14	0.46	0.60
White Hake	2.98	2.49	0.24	0.24	
Total Groundfish Landed	**26**	**5**	**2**	**10**	**7**
Pelagic Fish Landings					
Alewife	3.89	0.45	0.48	0.84	
Bluefin Tuna	82.11	33.83	6.16	32.47	35.22
Eel	4.44	9.76	6.36	5.82	
Herring	1612.58	1235.31	13.45	22.79	5.05
Mackerel	50.46	84.89	115.24	252.07	82.78
Shark, Blue			0.01		0.23
Shark, Mackerel		0.27			
Smelt	0.46	1.03	0.39	0.71	
Unspecified, Pelagic				0.63	
Total Pelagic Fish Landed	**1,754**	**1,366**	**142**	**315**	**123**
Invertebrate Landings					
Crab, Spider/Toad				0.28	
Jonah Crab		0.17	0.55	0.59	0.04

Table 6.29 Landings of Commercial Species in DFO Unit Area 4Wd (tonnes/yr)					
Species	**1998**	**1999**	**2000**	**2001**	**2002**
Lobster	264.02	266.35	306.87	394.90	273.43
Oyster				0.35	
Rock Crab	14.37	34.36	54.90	70.45	41.76
Scallop	7.56				8.88
Sea Urchin	327.35	299.80	196.62	105.79	10.14
Shrimp	928.75	2322.02	2883.06	2142.91	856.43
Snow Crab (Queen)	879.10	1044.55	2051.78	2097.30	2773.85
Soft Shell Clam	54.14	10.09	124.45	0.07	
Squid			11.23	7.91	
Stone Crab		0.05			
Unspecified, Squid		1.42			
Whelk	0.01	0.04	0.04		
Total Invertebrates Landed	**2,475**	**3,979**	**5,630**	**4,821**	**3,965**
Total Fish Landed	**4,256**	**5,349**	**5,774**	**5,145**	**4,095**

Table 6.30 Fishing Seasons in Study Area												
Fish Species	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Halibut	■	■	■	■	■	■	■	■	■	■	■	■
Groundfish	■	■	■	■	■	■	■	■	■	■	■	■
Herring	■	■	■								■	■
Mackerel	■	■	■	■	■	■	■	■	■	■	■	■
Lobster				■	■	■	■					
Rock Crab								■	■	■	■	■
Scallop	■	■	■	■					■	■	■	■
Sea Urchins	■	■	■	■	■	■	■	■	■	■	■	■
Shrimp	■	■	■	■	■	■	■	■	■	■	■	■
Snow Crab								■	■			

Note: This table represents main fishing seasons (shaded squares) as reported through consultations with fishing organizations.

Groundfish

From 1998 to 2002, the groundfish catch in Area 4Wd ranged from 0.04 to 0.62%, by weight, of the entire catch. The largest contributors to the groundfish catch over this time were cod and Atlantic halibut. However, in 1998, pollock contributed significantly to the overall groundfish catch.

According to Breeze *et al.* (2002), the main groundfish fishing restrictions overlapping with DFO Unit Area 4Wd is a gillnet restriction for catching cod and haddock. Locations of groundfish catches from 1998 to 2002 in DFO Unit Area 4Wd are shown in Figure 6.13.

Pelagic fish

From 1998 to 2002, 3 to 41% of the total catch in DFO Unit Area 4Wd was of pelagic fish. The peak catch in 1998 of 1,754 tonnes declined to 123 tonnes in 2002. This is almost entirely attributed to a drastic decline in the herring fishery over that time. The location and size of herring catches at any given location on the Atlantic coast are typically highly variable from year to year.

BEAR HEAD LNG TERMINAL

Figure 6.13
Groundfish 1998-2002

DFO Unit Area

Catch Data

Groundfish 2002
- Cod
- Haddock
- Monkfish
- Unspecified Flounder
- Halibut

Groundfish 2001
- Cod
- Cusk
- Haddock
- Monkfish
- Halibut
- Pollock
- White Hake
- Unspecified Flounder

Groundfish 2000
- Cod
- Cusk
- Haddock
- Monkfish
- Unspecified Flounder
- Pollock
- White Hake
- Halibut

Groundfish 1999
- Cod
- Cusk
- Haddock
- Monkfish
- Unspecified Flounder
- Pollock
- White Hake
- Halibut

Groundfish 1998
- Cod
- Cusk
- Haddock
- Monkfish
- Unspecified Flounder
- Pollock
- White Hake
- Halibut

Observer Data (2001)
- Cod

Only 2001 Observer Data is Located in Study Area & No Observer Data Available for 2002

Note: In some cases 3,4 & 5 points are in one location

N

0 4 8 12 16 20

Kilometres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Zone: 20
Datum: NAD 83
Scale: 1:500,000
Project Number: NSD17393
Date: April 19, 2004

Data Source: DFO Commercial Fisheries Catch and Observer Databases

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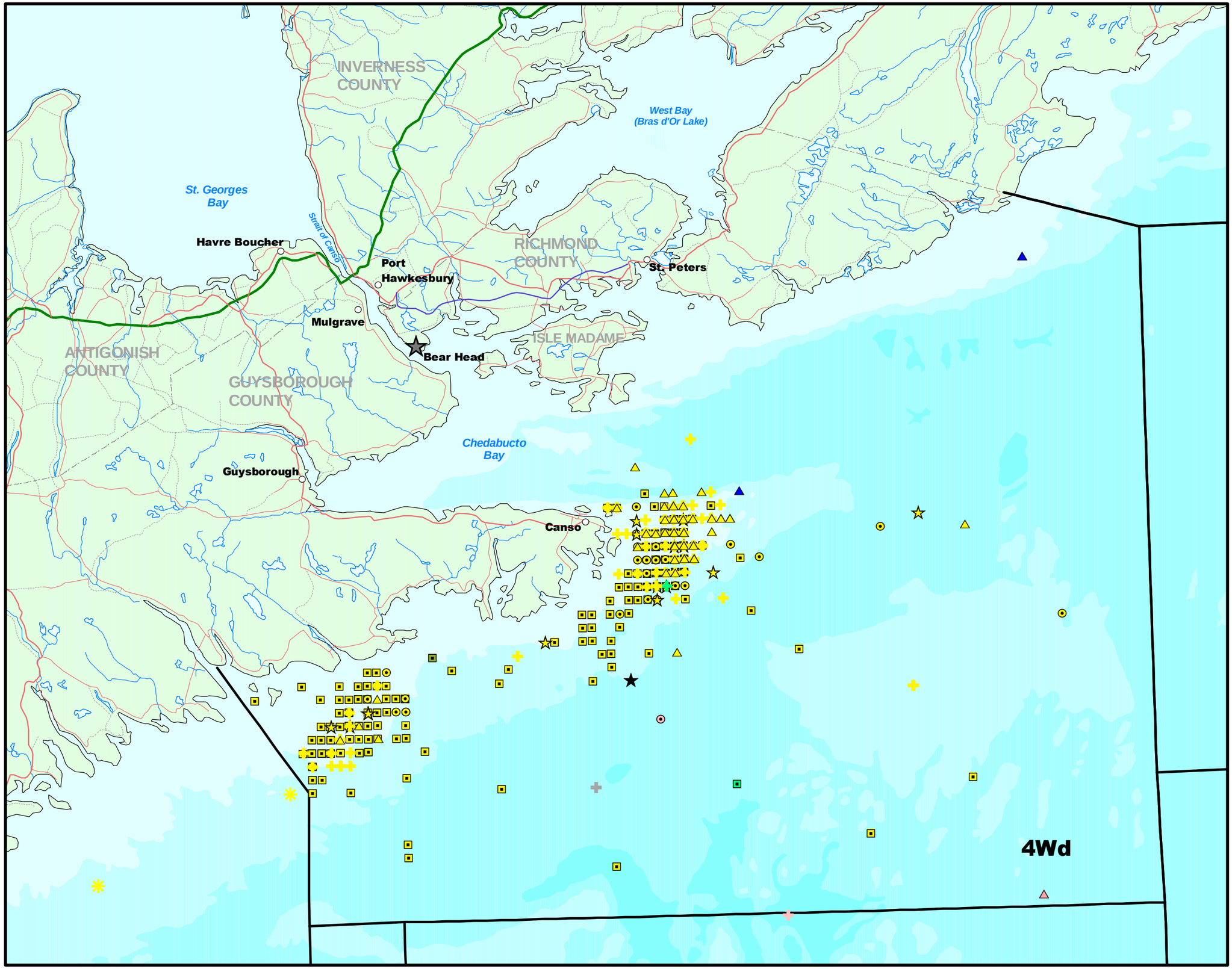
The main restrictions affecting large pelagic fisheries in DFO Unit Area 4Wd are a tuna closure where fishing of bigeye, yellowfin, and albacore tunas is prohibited and bluefin tuna can only be fished with rod and reel. Near the Project area, in the Strait of Canso and Chedabucto Bay, herring is caught using traps and weirs and there is, therefore, a year-round mobile gear closure in this area. In the remainder of DFO Unit Area 4Wd, there is a mobile gear and midwater trawl (vessels <19.5 m only) closure from January 1 to April 30 and from May 16 to October 14, respectively (Breeze *et al.* 2002). Locations of pelagic fish catches (including shark) from 1998 to 2002 in DFO Unit Area 4Wd are shown on Figure 6.14. Locations of herring and mackerel catches are shown on Figure 6.15.

There are two licensed mackerel traps in the Strait of Canso (Figure 6.16). The traps are set in place with the help of 17 anchors ranging from 200 to 1000 kg with lines running up to 150 fathoms from the trap to the anchors (C. Warner, pers. comm., 2004). Two peaks of mackerel catches occurs around mid-May and mid-October (C. Warner, pers. comm., 2004).

Invertebrates

Invertebrate fisheries contributed most substantially to the overall commercial fishery, ranging from 58-97% of the total annual catch in the period from 1998 to 2002. During that time, the snow crab fishery has increased every year from a low of 879 tonnes in 1998 to 2,774 tonnes in 2002. The next substantial fishery, the shrimp fishery, peaked in 2000 at just over 2,000 tonnes and has decreased to 856 tonnes by 2002. Most of the shrimp catches occur from fall to spring (P. Koeller, pers. comm., 2004). Lobster catches are also significant in Area 4Wd and have remained relatively stable from 1998 to 2002. Locations of invertebrate catches from in 2002 in DFO Unit Area 4Wd are shown in Figure 6.17. Shellfish catches from 1998 to 2001 are included in Appendix F. Lobster catches are not indicated on these figures because their catches are not recorded by location. An exploratory rock crab season also occurs in the vicinity of the project (Areas 29 and 31a) and can begin one week after the lobster season ends until December 31 (J. Tremblay, pers. comm., 2004). In recent years, there has not been a request from fishers to fish rock crab from January 1 until one week before the lobster season opens (M. Butler, pers. comm., 2004). Discussions with local fishermen revealed an increase in lobster catches last year to levels not seen in a long time (C. Warner and P. Kehoe, pers. comm., 2004). Snow crabs are caught in deeper waters and in higher numbers in an area located southeast of Isle Madame. Crab traps are set all the way to the shipping lane running south of Isle Madame (P. Kehoe, pers. comm., 2004).



BEAR HEAD LNG TERMINAL

Figure 6.14

Pelagic & Shark 1998-2002

DFO Unit Area

Catch Data

Pelagic 2002
- Bluefin Tuna
- Turbot

Pelagic 2001
- Alewife
- Bluefin tuna
- Redfish
- Turbot
- Unspecified Pelagic

Pelagic 2000
- Alewife
- Bluefin Tuna

Pelagic 1999
- Alewife
- Bluefin Tuna
- Turbot

Pelagic 1998
- Alewife
- Bluefin Tuna
- Redfish
- Swordfish
- Turbot

Shark 2002
- Blue Shark

Shark 2001
- Porbeagle Shark

Shark 2000
- Blue Shark

Observer Data (2001)
- Bluefin Tuna

No Shark Observer Data is located in Study Area and Only 2001 Pelagic Observer Data is Located in Study Area . No Observer Data Available for 2002

Note: In some cases 3,4 & 5 points are in one location

N

0 4 8 12 16 20

Kilometres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Zone: 20
Datum: NAD 83
Scale: 1:500,000
Project Number: NSD17393
Date: April 19, 2004

Data Source: DFO Commercial Fisheries Catch and Observer Databases

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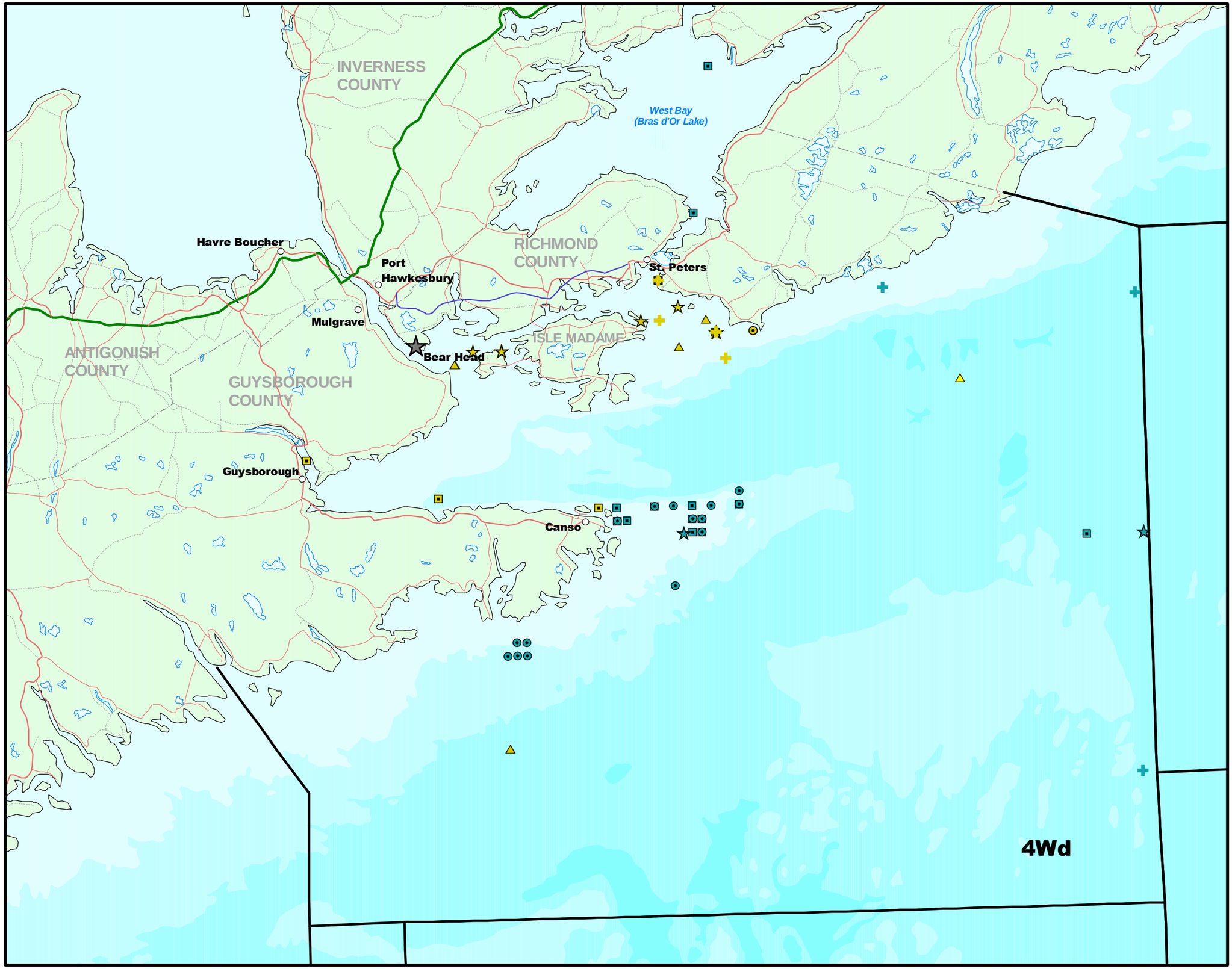
BEAR HEAD LNG TERMINAL

Figure 6.15

Herring and Mackerel 1998-2002



DFO Unit Area

Catch Data

2002
- Mackerel

2001
- Herring
- Mackerel

2000
- Herring
- Mackerel

1999
- Herring
- Mackerel

1998
- Herring
- Mackerel

Observer Data

No Observer Data (1998 to 2001) is Located in Study Area & No Observer Data Available for 2002

N

0 4 8 12 16 20

Kilometres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Zone: 20
Datum: NAD 83
Scale: 1:500,000
Project Number: NSD17393
Date: April 27, 2004

Data Source: DFO Commercial Fisheries Catch and Observer Databases

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BEAR HEAD LNG TERMINAL

Figure 6.16

Fishing Locations

Legend

- Mackerel Trap Locations
- Lobster (12-16 Fathom or Less)
- Rock Crab
- Scallop
- Rivers
- County Lines
- Fishing Locations
- Lakes

N

0 2000 4000 6000 8000

Metres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Zone: 20
Datum: NAD 83
Scale: 1:200,000
Project Number: NSD17393
Date: April 19, 2004

Source: Consultation with Fishing Industry

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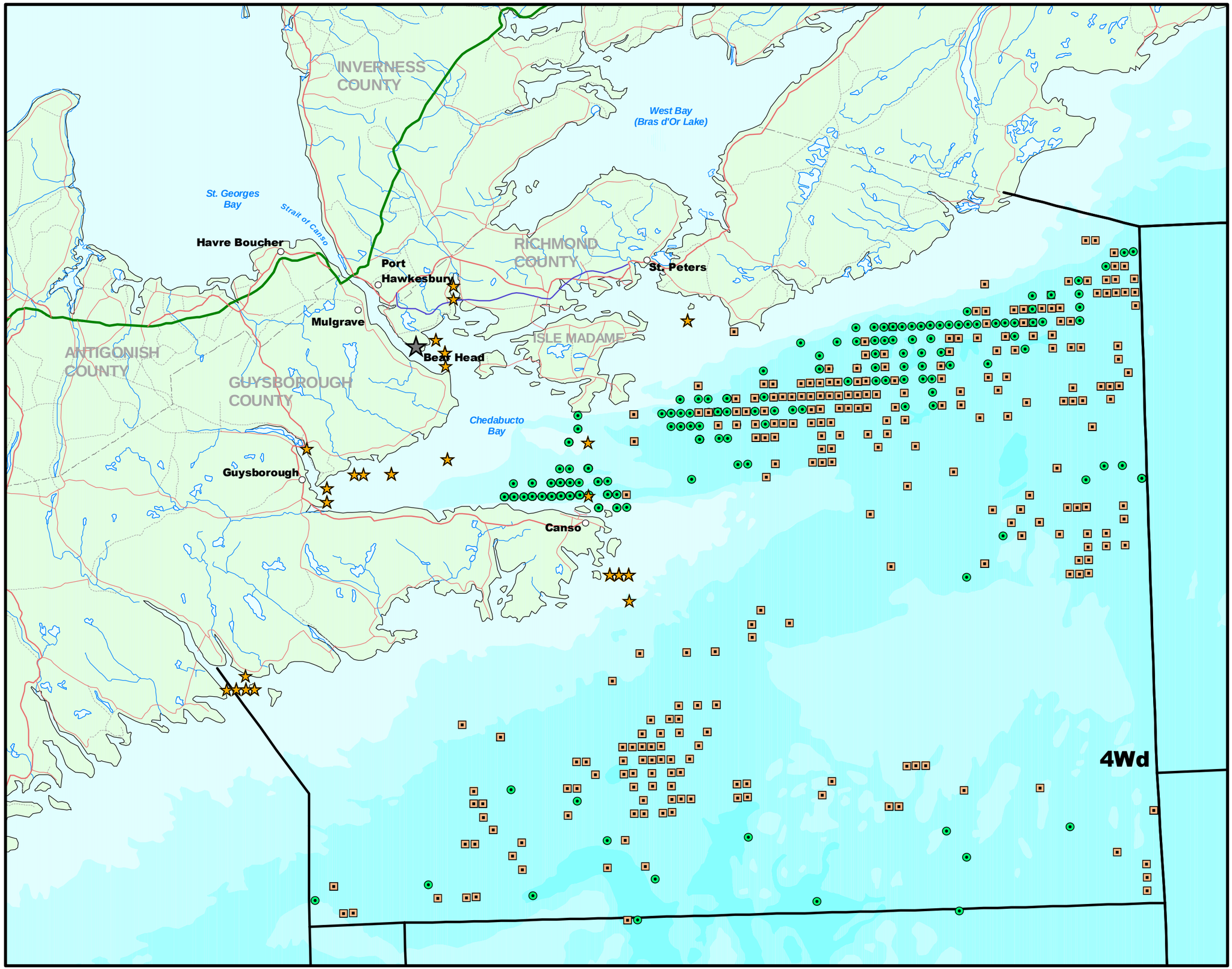

BEAR HEAD LNG TERMINAL

Figure 6.17

Shellfish 2002

DFO Unit Area

Catch Data

- Shrimp
- Rock Crab
- Snow Crab (Queen)

Observer Data

No Observer Data Available for 2002

Note: Lobsters are not shown on this figure because they are trapped.

N

0 4 8 12 16 20

Kilometres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Zone: 20
Datum: NAD 83
Scale: 1:500,000
Project Number: NSD17393
Date: April 19, 2004

Data Source: DFO Commercial Fisheries Catch and Observer Databases

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6.2.3.2 Recreational Fishery

There are reports of sport diving for scallops in the Strait area and sport fishing for trout and salmon (D. Hart; R. MacIsaac, pers. comm., 2004). It is likely there is some very minimal recreational fishing for mackerel close to the Project site in Bear Island Cove (D. Hart, pers. comm., 2004). However, most recreational mackerel fishing takes place off the Causeway and local wharves and piers around Port Hawkesbury as well as southeast of the tip of Bear Head. (D. Hart; R. MacIsaac, pers. comm., 2004).

Recreational fishers or anglers use the dirt road around the proposed site of the LNG facility to launch their boats from the beach located at the southern end of Bear Head (R. MacIsaac, pers. comm., 2004). The access to the launching point is important since there are no other quality launching facilities in the area off Bear Head (MacIsaac, pers. comm., 2004). Most of the recreational fishery in the area occurs in August, September, and October. Brook and speckled trout are also targeted by anglers (R. MacIsaac, pers. comm., 2004). There are at least 20 anglers that launch from Bear Head point. Also at the southeastern point of Bear Head is a pond containing a mussel bed regularly harvested by recreationalists (R. MacIsaac, pers. comm., 2004).

A boat charter (Ship Harbour Boat Tours and Charter Services Limited) is based out of Port Hawkesbury and possesses an educational Lobster Fishing License to fish three lobster traps. However, no other fishing occurs from the boat which tours the Strait area (R. MacIsaac, pers. comm., 2004).

No recreational fishing occurs in the two streams located in the vicinity of the proposed facility due to the small size of the watercourses.

6.2.3.3 Aquaculture

Aquaculture leases are separated in two categories, proposed and issued. The proposed leases located east of Bear Head will probably not be issued for a few years (E. Sampson, pers. comm. 2004) (Figure 6.18). Three aquaculture leases are issued for an area southwest of Bear Head (Figure 6.18). Some of these aquaculture sites are not cultivated every year (E. MacEachern, pers. comm. 2004). Species cultivated at these sites are Atlantic salmon and steelhead salmon.

BEAR HEAD LNG TERMINAL

Figure 6.18

Aquaculture Leases

Existing Aquaculture Sites: Species

- American Oyster, Blue Mussels, Sea Scallops
- Atlantic Salmon, Steelhead Salmon
- Blue Mussels
- Sea Scallops
- Sea Scallops, Blue Mussels
- Speckled Trout, Atlantic Salmon, Brown Trout, Rainbow Trout
- Steelhead Salmon

Proposed Aquaculture Sites : Species

- Blue Mussels
- Rainbow Trout

N

0 2000 4000 6000 8000

Metres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Zone: 20
Datum: NAD 83
Scale: 1:200,000
Project Number: NSD17393
Date: April 19, 2004

Data Source: Government of Nova Scotia Website

Jacques Whitford

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6.2.4 Land Use

6.2.4.1 Industrial, Commercial and Residential Development

Industrial and Commercial

The Project lies on provincial Crown Land designated for heavy industrial development. The Municipality of the County of Richmond, in their Municipal Planning Strategy for West Richmond, has designated the area as Port Industrial (I-2) zoning (Rural Cape Breton District Planning Commission 2000b) (Figure 6.19). This designation includes intended uses of the lands for fuel bunkering, marine terminals, and other heavy industrial or port activities as required. Specifically, the County of Richmond has identified the area for petrochemical and marine facility developments.

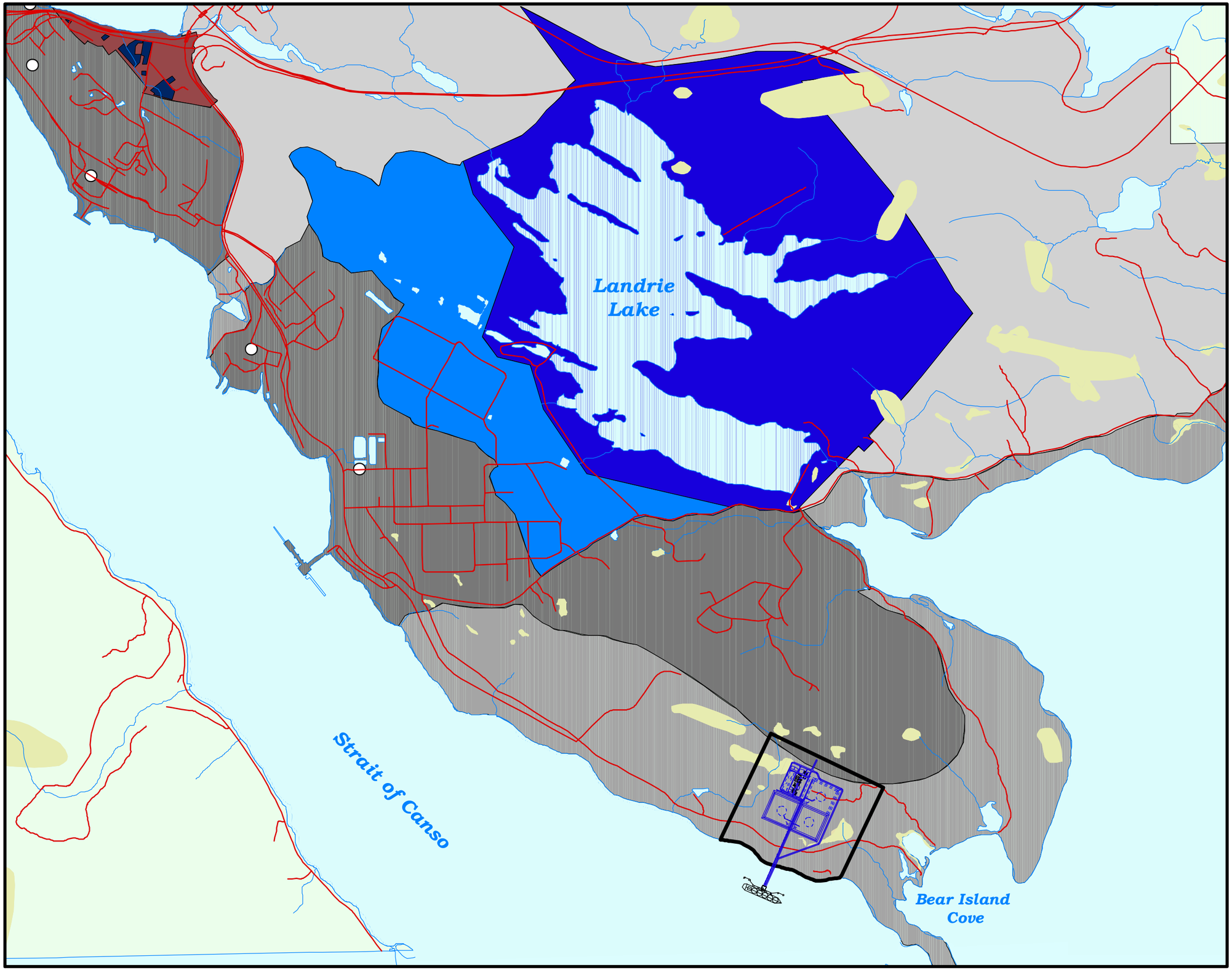
Stipulations related to Port Industrial (I-2) zoning include the following:

- Development in the zone must be a minimum lot area of 29, 000 ft^2; and
- In cases where a non-residential use (*e.g.*, I-2 zoned activities) abuts a residential use: (i) the non-residential use shall not have open storage or display open storage within 20 feet of a side or rear lot line, and (ii) no parking shall be permitted in an abutting yard within 20 feet of a residential lot line (RCBDPC 2000b).

The other tenants in the Point Tupper/Bear Head Industrial Park include (Figure 6.20):

- Statia Terminals - An oil and gas trans-shipment terminal which has a staff of 80 employees;
- ExxonMobil Canada - A natural gas processing/fractionation plant which has a staff of 70 employees;
- Nova Scotia Power - A coal fired electrical generating plant which has a staff of 75 employees; and
- Stora Enso - A pulp and paper mill which has a staff of 800 employees.

There is no commercial development or commercially zoned areas in Point Tupper.



BEAR HEAD
LNG TERMINAL

Figure 6.19

Land Use Zoning

Legend

- ANE Property Boundary
- Rivers & Streams
- Roads
- Wetlands
- Land
- Water

Zones

- Watershed Protection (W-1)
- WS Protection Periphery (W-2)
- Open Spaces (OS)
- Port Industrial (I-2)
- Residential (R-1)
- Light Industrial (I-1)
- Heavy Industrial (I-3)

N

0 200 400 600 800 1000

Metres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Datum: NAD83
Zone: 20
Scale: 1 : 25,000
Project Number: NSD17393
Date: April 21, 2004

Data Source: Rural Cape Breton District Planning Commission 2003

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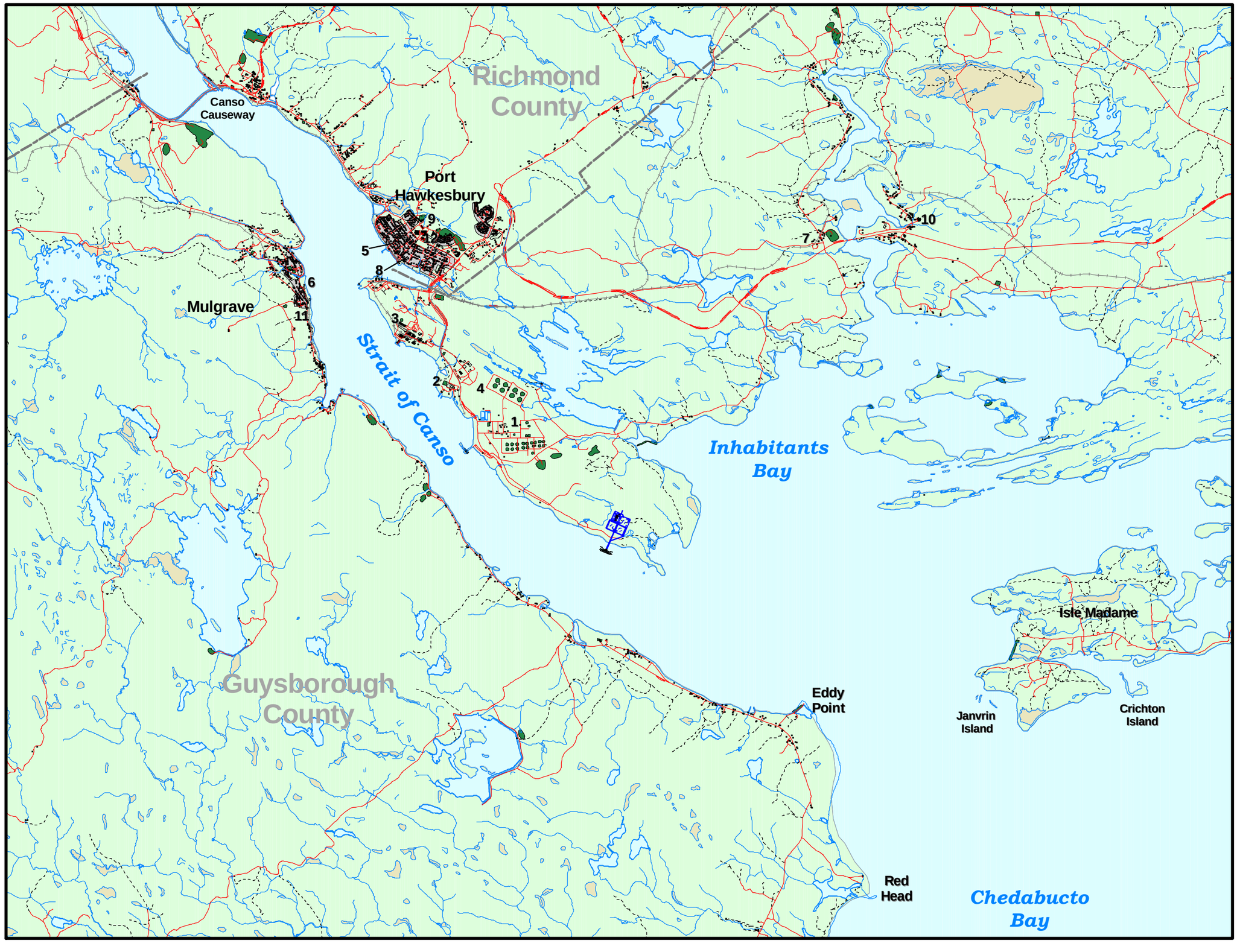
BEAR HEAD LNG TERMINAL

Figure 6.20
Development Features



Legend

- Dwellings
- County Lines
- Railroads
- Cart Track
- Roads
- Rivers
- ANE Site Boundary
- ANE Property Boundary
- Wetlands
- Lakes
- Built Up Areas
- Buildings
- Features

Numbered Features

1. Statia Terminals
2. Nova Scotia Power
3. Stora-Enso
4. Exxon Mobil Canada
5. Town of Port Hawkesbury
6. Town of Mulgrave
7. Strait Richmond Hospital
8. Strait Area Education Recreation Centre
9. Tamarac Education Centre
10. West Richmond Education Centre
11. Mulgrave Memorial Education Centre
12. Port Hawkesbury Nursing Home

N

0 1 2 3

Kilometres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Datum: NAD83
Zone: 20
Scale: 1 : 80,000
Project Number: NSD17393
Date: April 19 2004

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Residential

The Point Tupper area was once a village that included homes, a hotel, two churches, a railroad station and a few stores (Rural Cape Breton District Planning Commission (RCBDPC) 2000a). A ferry once ran from Mulgrave across the Strait of Canso to Point Tupper. In the 1970s, the Province of Nova Scotia expropriated the land in the area for industrial development (J. Bain, pers. comm., 2003). While most of the residents were relocated, a small group of homeowners stayed and continue to live within the industrial park. The Municipal Planning Strategy for West Richmond has designated their lands as residential (R-I) (Figure 6.19). There are roughly ten homes and one church that remain from the previous community (RCBDPC 2000a). These residents have formed a group called the Point Tupper Heritage Association, and the church has been developed by the association as a museum (RCBDPC 2000a).

The largest residential population centres to Point Tupper (within a 10 km radius) include the town of Port Hawkesbury and the town of Mulgrave located across the Strait of Canso (Figure 6.20). Port Hawkesbury covers a land area of 8.35 km^2 and has a population density of 443.5 per km^2. In 2001, the population of Port Hawkesbury was 3,701 (Statistics Canada, 2001a). Over 80% of the population is aged 15 and over, with 28% (1,040) between the ages of 25 to 44 (Statistics Canada, 2001a). The town of Mulgrave is a smaller centre than Port Hawkesbury, covering a land area of 17.81 km^2 and with a population of 904 in 2001.

The greater Richmond County area includes the Town of Port Hawkesbury, Town of Mulgrave and the Project site. The total population was 10,225 in 2001 which covers a 1,244 km^2 area (Statistics Canada, 2001b). Over 80% of the population in the County is aged 15 and over, with 28% (2,965) aged 0 to 24, and 72% (7,260) aged 25 years and older (Statistics Canada 2001b).

Recreation Areas

The Nova Scotia Sport and Recreation Commission (NSSRC) has no record of provincial canoe, sea kayaking, hiking or snowmobile trails in the Point Tupper and Bear Head Area (NSSRC 2003). The closest described sea kayaking route to the project site is located around Isle Madame and Janvrin Island (NSSRC, 2003). The closest trails to the project site are in St. Peter's area, Isle Madame and around Port Hawkesbury (J. Vance, pers. comm., 2003). The trail system near Port Hawkesbury, the Centennial Woodland Trail, is a 5 km hiking trail that was funded by Stora Enso and has views of the Strait of Canso (Environmental Design and Management Limited (EDM) 2000).

There has been some discussion about developing a hiking trail system along the abandoned railroad between St. Peter's and Port Hawkesbury (St. Peter's Spur), but these discussions are still in the preliminary stages (J. Vance, pers. comm., 2003; S. Vines, pers. comm., 2003). Point Tupper was originally included in an area delineated for future Trans Canada Trail development (*Nova Scotia Sport*

and Recreation Commission, 2003). However, the trail is now being developed on the western side of Inverness County and is not likely to connect or pass through the Point Tupper area (S. Vines, pers. comm., 2003).

The Nova Scotia Trails Federation reports that none of their community trail group members operate in the area (J. Vance, pers. comm., 2003). Organized walking and hiking groups in Richmond County, such as the Cape Breton Island Hoppers Volkssport Club, do not use the Point Tupper area but do hike the Centennial Woodland Trail system north of Port Hawkesbury (R. Coombes, pers. comm., 2003). The local planning office reports no plans to develop trails in the area (J. Bain, pers. comm., 2004). Some locals do use the road near the Project site for daily recreational walks (D. Hart, pers. comm., 2004).

Bear Head is also a location for some recreational hunting. It is reported that there is some hunting for deer, partridge and wild ducks that takes place in the fall in the woods around Bear Head (A. England, pers. comm., 2003; R. MacIsaac, pers. comm., 2004). However, the local fish and game association in Port Hawkesbury reports that hunting is limited in the area because of the close proximity to the Landrie Lake protected water supply watershed (see Figure 6.19) and the prominence of fenced areas associated with other developments in the industrial park (R. MacIsaac, pers. comm., 2004).

There is some recreational boating around the Bear Head area, including sailing and power boating (D. Hart, pers. comm., 2004). One boat tour operator started operation in 2003, taking tourists down the coastline through the summer months until October (D. Hart, pers. comm., 2004).

Areas of Special Community Value

The Bear Head area is not heavily used by the local community, although it is a spot used by recreational walkers and weekend revelers who use the main road and sometimes have campfires near Bear Head Cove (A. MacDonald, pers. comm., 2003; D. Hart, pers. comm., 2004). Locals report that recreational walkers like the area because it does not have steep grades, and it is a popular place for "therapy walking" among those who have health conditions (D. Hart, pers. comm., 2004). The area is also used by locals as a dumpsite for various types of trash (*e.g.,* carpeting, washing machines, mattresses) (A. MacDonald, pers. comm., 2003; A. England, pers. comm., 2003).

The Nova Scotia Community College (NSCC) in Port Hastings currently has two silviculture training sites at Bear Head (B. Lewis, pers. comm., 2003; B. Williams, pers. comm., 2004) (Figure 6.21). These include: one site which overlaps on the southeast corner of the Project footprint and which is scheduled for harvesting completion in June 2004; and another site located 100 m east of the Project's western survey line, at the end of the 1.3 km College Road. College Road was built by NSCC with assistance from the Forest Products Association (B. Williams, pers. comm., 2004).

BEAR HEAD LNG TERMINAL

Figure 6.21

Harvested Areas

College (NSCC)
Road - 1287 m

Strait of Canso

Bear Island Cove

Legend

- NSCC Road
- Roads
- Rivers & Streams
- ANE Site Boundary
- ANE Property Boundary
- Wetlands
- Lakes
- Nova Scotia Community College (NSCC) Silviculture Sites

N

0 100 200 300 400

Metres

Map Parameters
Projection: Universal Transverse Mercator (UTM)
Datum: NAD83
Zone: 20
Scale: 1 : 8,000
Project Number: NSD17393
Date: April 19, 2004

Jacques Whitford

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NSCC operates at Point Tupper under an agreement with the Nova Scotia Department of Natural Resources (B. Lewis, pers. comm., 2003). They use the Crown Land in the area for training, providing hands-on education for students under NSCC's Natural Resources Forestry Program (B. Williams, pers. comm., 2004). The program exposes students to harvesting techniques, mensuration and dendrology. The amount the sites are used varies depending on the courses, but NSCC consistently uses the sites daily from early November until mid-December. The second most common time for site use is between March and April. Other periods are determined by activity or training needs. NSCC usually accesses the sites using half-ton trucks. Classes normally include 12 to 20 students.

NSCC started using the land at Point Tupper for classes with the understanding that the area was designated for industrial development and that eventual project construction may affect training sites (B. Williams, pers. comm., 2004). However, NSCC wishes to continue using Crown land in the area because the eastern extreme of the area exhibits a diversity of ecological habitats in a concentrated area (B. Williams, pers. comm., 2004). Finding these habitat types in close proximity and on public land to the NSCC will be difficult. NSCC also expressed a desire to have continued road access in the area.

There is also some discussion in local folklore of old settlements in the Bear Head area. One folklore tale suggests that there is an old burial site at Bear Head. The story involves either a shipwreck or a ship plague that claimed the life of all passengers on board who were then buried at Bear Head. This story was first introduced during NSCC negotiations with the Nova Scotia Department of Natural Resources regarding their silviculture program. The story has been researched but no evidence of a gravesite has been found (A. MacDonald, pers. comm., 2003). The archaeological and heritage resource survey conducted as part of this study (see Section 6.2.1) also found no evidence to support such a story. There is evidence of an old community development near Bear Island Cove. Refer to Section 6.2.1 for the results of the archeological and heritage resources study in that area.

During the public consultation sessions related to initial planning and zoning issues of Point Tupper in 2000, a local resident made a presentation arguing for the designation of the point at Bear Head and Bear Island Cove as a park (J. Bain, pers. comm., 2003). The intention was to have a park and recreation area in the industrial park for tenants and Port Hawkesbury residents.

6.2.5 First Nations Land and Resource Use

ANEI has commissioned a Mi'kmaw Knowledge Study (MKS) to identify any First Nations land or resource use potentially affected by Project development (refer to Appendix J). A number of current uses have been identified within a five km radius of the site including, food and commercial fishing and firewood harvesting. A low to moderate potential of the study area containing pre-Contact archaeological resources was noted in Section 6.2.1.

6.2.6 Community Services and Infrastructure

This section describes community services and infrastructure within the study area that could be affected by Project development, including: local emergency response (fire, medical, police); ongoing support (health, social services); accommodation, food services and entertainment; and transportation infrastructure.

6.2.6.1 Local Emergency Response Services

Fire

The Port Hawkesbury Fire Department serves Point Tupper and the Bear Head area. It is a volunteer department with 40 volunteer fire-fighters, two pumper trucks and a truck with an 85 foot water tower (D. Sellers, pers. comm., 2003). The pump capacity for the two pumper trucks is 1,050 imperial gallons, while the capacity of the water tower vehicle is 1,250 imperial gallons. There are plans to upgrade the capacity of one of the pumper trucks to 1,500 imperial gallons in 2004 (D. Sellers, pers. comm., 2003). Response time for the Port Hawkesbury Fire Department is six minutes to mobilize out of the hall in the middle of the night.

In addition to the Port Hawkesbury Fire Department, the Point Tupper area can be served by nine other volunteer fire departments in Richmond County during emergencies. Additional volunteer fire departments are located in the communities of West Bay Road, Louisdale and District, Isle Madame, St. Peter's and District, L'Ardoise, Grand River, Framboise-Fourchu, Loch Lomond and District 10. In addition to these centres, all of the fire departments within Richmond and Inverness County are part of a mutual aid system for emergency fire response and can be mobilized depending on the extent of the accidents (D. Sellers, pers. comm., 2003). Currently within Point Tupper, the Port Hawkesbury Fire Department coordinates emergency response procedures with one tenant, ExxonMobil, for their gas fractionation plant.

Medical

The Point Tupper and Bear Head area is served by the Guysborough Antigonish Strait Health Authority (GASHA), which is the provincial district health authority for the regions of Guysborough County, Inverness County, Richmond County and Antigonish County. Under GASHA jurisdiction, there are five hospitals in operation: St. Martha's Regional Hospital (Antigonish, Antigonish County); St. Mary's Memorial Hospital (Sherbrooke, Guysborough County); Guysborough Memorial Hospital (Guysborough, Guysborough County); Eastern Memorial Hospital (Canso, Guysborough County); and the Strait Richmond Hospital (Evanston, Richmond County).

The Strait Richmond Hospital is the closest hospital serving the Point Tupper and Port Hawkesbury area (M. Foroutan, pers. comm., 2003). It is located in Evanston, Richmond County and is approximately 16 km from Port Hawkesbury. The hospital has 15 medical beds, as well as a large number of services and programs (Table 6.31).

As the Strait Richmond Hospital is a community hospital, it does not provide critical care for major trauma injuries or for maternity procedures (*e.g.*, deliveries). For these services, residents must travel either to the St. Martha's Regional Hospital in Antigonish or the Cape Breton Regional Hospital in Sydney, where there are intensive care units, coronary units, neonatal intensive units and renal dialysis services (M. Foroutan, pers. comm., 2003) (Table 6.31).

Emergency Health Services (EHS) operates four ground ambulances in Port Hawkesbury. These service units are located in the Port Hawkesbury Business Park and in Arichat on Isle Madame. The ambulance fleet is monitored by the dispatch centre in Halifax (EDM 2000). There is also air ambulance service through EHS in the area and a helipad at the Strait Richmond Hospital (M. Foroutan, pers. comm., 2003).

Police

Individual tenants at Point Tupper are responsible for security on their premises but the RCMP maintains regular park patrols. The Port Hawkesbury RCMP Detachment, which has 18 members (A. Gillis, pers. comm., 2003), is the detachment directly responsible for the Point Tupper and Bear Head area. They provide general policing and emergency response services to Port Hawkesbury and surrounding areas. The Port Hawkesbury Detachment has a total of 10 vehicles available and are within a 10 minute drive from Point Tupper. Other detachments available to service the area in an emergency situation include St. Peter's Detachment (six members) and Arichat Detachment (three members) (A. Gillis, pers. comm., 2003).

6.2.6.2 On-going Support Services

Health

Community health programs are coordinated for the Point Tupper and Port Hawkesbury region through the Strait Richmond Community Health Board (SRCHB). This provincial board oversees health programs in the areas of the Strait, Richmond County and the lower portion of Inverness County. The SRCHB is the main provincial organization that ensures community-based health services are being offered to residents, co-ordinates with other communities to share primary care services, and assists with public education.

Table 6.31 Hospitals Servicing the Point Tupper and Port Hawkesbury Area			
Hospital	**Strait Richmond Hospital**	**St. Martha's Regional Hospital**	**Cape Breton Regional Hospital**
Location	Evanston (Richmond County)	Antigonish (Antigonish County)	Sydney (Cape Breton County)
Approximate Travelling Time From Port Hawkesbury	20 min	45 min	1.5 hrs
Number of Beds	15	75	268
Services	**Primary Services:** • Emergency • Core diagnostic • Physiotherapy • Nutrition and dietetic counseling • Diabetes education centre • Social work services • General surgery clinics • Orthopedics clinics • Medicine clinics • Ophthalmology clinics • Rheumatology clinics • Pediatrics clinics • Palliative care and vascular surgery clinics • Satellite hemodialysis unit	**Primary and Secondary Services:** • Emergency • Ambulatory • General surgery • Gynecology • Ophthalmology • Otolaryngotomy (ENT) • Plastic surgery • Palliative care • Obstetrics • Pediatrics • In and out-patient mental health services • Pathology • Diagnostic imaging • Physiotherapy • Occupational therapy • Cardiorespiratory • Diabetes education • Social work services	**Primary, Secondary and Tertiary Services:** • Emergency • Ambulatory • Diagnostic imaging • Ultrasound • Mammography • CT scan • Nuclear medicine • Angiography • Diabetes education • Medical social work • Endocrinology • Geriatric medicine • Acute care services • Laboratory centre • Critical care (intensive care, coronary care, etc) • Specialty surgery • Mental health programs • Occupational therapy • Physiotherapy • Respiratory therapy • Speech therapy • Palliative care
Source: GASHA (2003); Cape Breton District Health Authority (2003); P. Mills, pers. comm., 2003			

The nearest health service centre to the Project is the Public Health Services' Port Hawkesbury office. This office provides advice and services related to nutrition, health education, dental care, prenatal and postnatal assessments, and provision of immunizations. The staff in the Public Health Office include nurses, dental hygienists, nutritionists, and health educators (SRCHB 2003).

Within Port Hawkesbury and the general area, a variety of health services are offered through local providers. These include physicians, dentists, optometrists, chiropractors, massage therapists and holistic services (Table 6.32).

Table 6.32 Health Services for the Point Tupper and Port Hawkesbury Area

Type of Health Service	Number of Service Providers	Location
Physicians	5	Port Hawkesbury
Dentists	4	Port Hawkesbury
Optometrists	3	Port Hawkesbury
Hearing	1	Port Hawkesbury Antigonish
Holistic Services	1	Port Hawkesbury
Chiropractors	2	Port Hawkesbury Pictou
Physiotherapists	1	Port Hawkesbury
Chinese Medicine	1	Antigonish
Massage Therapist	1	Port Hawkesbury
Pharmacies	4	Port Hawkesbury

Source: SRCHB (2003)

Social Services

Residents of Point Tupper and the Port Hawkesbury area have access to a range of social services, including access to a mental health nurse and addiction services programs (related to alcohol, drug and gambling dependent lifestyles) located at the Strait Richmond Hospital. In addition, there are over 60 social and human service organizations listed for the region (SRCHB 2003) including Canadian Red Cross societies, the Eastern Regional Help Line, seniors clubs, social clubs, food banks and literacy networks. Port Hawkesbury also has 45 churches (*e.g.,* Anglican, Baptist, Catholic, United and United Baptist) and over 20 churches within commuting distance. There are also three employment/career service centres in Port Hawkesbury providing guidance, education and training (SRCHB 2003).

6.2.6.3 Accommodation, Food Services and Entertainment

Accommodation

There are a total of six hotels and three bed and breakfasts in Port Hawkesbury and Port Hastings providing year-round accommodation, with a total of 328 rooms (Table 6.33). These accommodations generally include a double bed and a bathroom. All hotels have in-house restaurants and some have fitness facilities. Between 2000-2003, the occupancy rate for hotels in the area fluctuated between 54.8 and 49.7% for the months of May to October (J. Falconer, pers. comm., 2003) (Table 6.34).

Table 6.33 Accommodation in Port Hawkesbury and Vicinity		
Type of Accommodation	**Room Capacity**	**Location**
Hotel and Inns (6)		
Econo Lodge (Mac Puffin Motel)	32	Port Hawkesbury/Port Hastings
Howard Johnson Inn	44	Port Hastings
Maritime Inn Port Hawkesbury	75	Port Hawkesbury
Port Hawkesbury Motel	28	Port Hawkesbury/Port Hastings
Cove Motel	85	Aulds Cove
Sky Lodge	49	Canso Causeway
Bed and Breakfast (3)		
Hawbourview Bed and Breakfast	7	Port Hawkesbury
La Marguerite Bed and Breakfast	4	Port Hawkesbury
MacKenzie House Bed and Breakfast	4	Port Hawkesbury

Table 6.34 Occupancy Rate of Hotels				
Hotels (6) (Cove Motel, Port Hawkesbury Motel, Sky Lodge, Maritime Inn Port Hawkesbury, Econo Lodge (Mac Puffin Motel), Howard Johnson Inn)	**Occupancy Rate (May – October)**			
	2000	**2001**	**2002**	**2003**
Occupancy Rate %	54.8	49.5	47.8	49.7
Rooms Sold	50,433	45, 049	44, 524	47, 288
Source: J. Falconer, pers. comm., 2003				

There are a number of apartment rental groups with accommodations available in the Port Hawkesbury area. These include the Armel Apartments (seven buildings), Springhurst Apartments (seven buildings), and the Strait Apartments (four buildings). The apartments generally have the following characteristics (S. Praught, pers. comm., 2003; C. Hunt, pers. comm., 2003):

- include hot water and heat in rental price;
- are unfurnished;
- have month-to-month leases;
- include one bedroom, two bedroom and three bedroom units;
- generally have 12-15 units per apartment building; and
- range in rental price from $489-535 (1 bed.), $545-565 (2 bed.), and $567-635 (3 bed.).

In addition, there are several real estate agencies in Port Hawkesbury and a number of smaller agencies that provide house rentals, generally during the tourism season (I. MacDonald, pers. comm., 2003).

Food Services

Food services in Port Hawkesbury include fast food restaurants (*e.g.*, A&W, Diary Queen, MacDonalds), full service restaurants (*e.g.*, Gold'N Ray Fish & Steak House, Rose Garden Chinese, Smitty's, Ship Harbour Restaurant), pizzerias, coffee shops (*e.g.*, Tim Hortons) and pubs. There are also several large grocery stores (*e.g.*, Strait Co-op, Superstore) and liquor stores.

Entertainment

There are a number of entertainment services in Port Hawkesbury, including a bowling alley, arena, recreation centres and community halls (Table 6.35). A new civic centre is under construction in Port Hawkesbury (M. Foroutan, pers. comm., 2003; I. MacDonald, pers. comm., 2003). In addition, there are over 31 active community-based clubs (*e.g.*, Lion's Clubs, boating/yacht clubs) (SRCHB 2003). There are two fitness centres in Port Hawkesbury and a public library. The closest movie theatre is in Antigonish, which is a 40 minute drive from Port Hawkesbury. A number of recreational programs are offered in Port Hawkesbury and the Richmond County area in places such as Arichat, Petit de Grat, Chapel Island, and St. Peters. These include arts and craft programs, sports activities and outdoor recreation (*e.g.*, hockey, kayaking, scuba diving) (Table 6.36).

Table 6.35 Recreation Centres in Port Hawkesbury and Vicinity

Centre	Services	Location
Port Hawkesbury Recreation Centre	• Auditorium • Pool • Library • Day care centre • Gymnasium	Port Hawkesbury
Riverdale Community Centre	• Community Hall	Cleveland
Body Basics Health and Fitness Studio	• Yoga • Lifestyle consulting • Health and wellness workshops	Port Hawkesbury
Richmond Arena	• Public skating and skating programs	Louisdale

Table 6.36 Recreational Programs Within Richmond County

Program	Examples of Activities
Arts and Crafts	• Marionnette puppet making • Song writing workshops • Dog obedience classes • Circus arts workshop • Learn to write classes • Stained glass courses • Ceramic Painting
Sports	• Tae Kwon Do • Tennis
General Classes	• B.O.A.T. Courses • Skating Lessons
Seasonal Outdoor Activities	• Hockey • Kayaking • Scuba diving • Golf • Water skiing

Source: Richmond County Municipal Services Newsletter (2003); Richmond County Tourism (2003)

Throughout the year, Richmond County hosts over 26 festivals and events for residents and tourists. These include seafood festivals, yacht races, Christmas festivities, music fairs, and a Celtic Colours Festival (Department of Tourism, Culture and Recreation 2003). There are also a number of trails, beaches and provincial parks in the County around Isle Madame and St. Peter's (Department of Tourism, Culture and Recreation 2003). These include:

- Rocky Bay Beach;
- Lennox Passage Provincial Park;
- Pondville Beach Provincial Park;
- St. Peter's Walking Trail;
- Battery Provincial Park;
- Point Michaud Beach Provincial Park; and
- Irish Cove Provincial Park.

6.2.6.4 Transportation Infrastructure

Road traffic will access the proposed LNG Terminal by Industrial Park Road from Trunk 4 in Port Hawkesbury to Statia Terminals, and then Bear Island Road to the LNG Terminal site. Trunk 4 is a Nova Scotia arterial road that connects with Trans Canada Highway 104 and 105 at Port Hastings, approximately 6.2 km west of the Trunk 4 / Industrial Park Road intersection. Trunk 4 in this area is a four-lane wide undivided road with 2004 estimated annual average daily traffic (AADT) volumes varying from 11,600 vehicles per day (vpd) west of Port Hawkesbury to about 14,000 vpd at the Trunk 4 / Industrial Park Road intersection.

The four lane sections of Trunk 4 and all of Industrial Park Road were constructed in the early 1970's to provide construction access for many major industrial projects, including Stora Enso, the NS Power Plant, an oil refinery, and a heavy water plant. In recent years, these roads have continued to provide construction access for extensive improvements at Stora Enso. The roads also provide daily access needs of several hundred employees in the Point Tupper area, as well as several hundred truck loads of pulp to Stora Enso and gypsum to the Georgia Pacific terminal. The section of Bear Island Road southerly of Statia Terminals was reconstructed primarily to provide an access road to the NS Power ash dump, where the road surface currently ends.

Traffic Volumes

During 2002 and 2003 the Nova Scotia Department of Transportation and Public Works (NSTPW) obtained machine traffic counts on Industrial Park Road between Trunk 4 and Statia Terminals. Average weekday two-way volumes just west of Trunk 4 were about 5,350 vehicles per day in October 2003, including peak hour volumes of about 450 vehicles per hour. Daily and peak hour volumes will be considerably lower in the road section between Point Tupper Road and the NS Power Plant entrance.

A count obtained south of the NS Power Plant entrance during August 2002 indicated average weekday volumes of 750 vehicles per day, including peak hourly volumes of about 75 vehicles per hour. While traffic count data are not available for Bear Island Road south of Statia Terminals, volumes are expected to be extremely low.

Daily volumes usually fluctuate from one time of year to another, with volumes usually being higher in the summer and lower in the winter. Volume fluctuations on the sections of Industrial Park Road between Trunk 4 and the NS Power Plant can be expected to be similar to suburban traffic patterns that only exhibit minor seasonal fluctuations. As illustrated in Table 6.37, volumes during the spring and fall seasons are about equal to estimated AADT, while winter volumes will be about 12% lower and summer volumes will be about 10% higher than AADT volumes.

Table 6.37 Seasonal Variation in Average Daily Volumes

Season	Average Daily Volume as a Percent of AADT
Winter (December, January, February, March)	88 %
Spring / Fall (April, May, October, November)	102 %
Summer (June, July, August, September)	110 %

Source: NSTPW permanent counter factors for Counter Group A

Road Descriptions for the Industrial Park and Bear Island Road

The distance from the Trunk 4 / Industrial Park Road intersection to the proposed LNG Terminal via Industrial Park Road and Bear Island Road is about 8 km. Road types vary from a 0.5 km section of four-lane undivided Industrial Park Road at the north end to about a 1 km section of abandoned and unmaintained Bear Island Road at the south end. Although the Bear Island Road is presently considered to be abandoned, NSTPW will most likely allow those who have use for the road to improve it at their own expense. Road descriptions for the Bear Head LNG Terminal access road sections are included in Table 6.38.

Table 6.38 Description of Industrial Park Road and Bear Island Road				
Road Name	**Location**	**km from Trunk 4**	**Cross Section Details**	**Notes**
Industrial Park Road	Trunk 4	0.0	Traffic signals at Trunk 4 intersection. 4 - 3.6 to 3.7 m wide lanes; shoulders are 1.0 m paved with about 3.0 m gravel.	Speed limit is 60 km/h from Trunk 4 to just south of Point Tupper Road. RA-5 overhead cross walk sign with push button actuated flashing lights exists over marked pedestrian cross walk at Queen Street.
	Queen Street	0.1		
	Granville Street	0.5		
	Point Tupper Road	0.9	3 lanes including left-turn lane	
	Stora Enso Pulp Yard	2.3	2 - 3.6 m lanes with 1.0 paved shoulders While pavement is badly broken from NS Power to Statia Terminals, other sections have very good paved surfaces.	Speed limit is 70 km/h from south of Point Tupper Road to the end of Bear Island Road. Road ends at the NS Power Ash Dump entrance.
	NS Power	2.9		
	Rail Road Crossing	3.0		
	Statia Entrance Road	4.5		
	Port Malcolm Road	5.1		
	Statia Terminals	5.2	2 - 3.6 m wide paved lanes	
Bear Island Road	NS Power Ash Dump	6.9		
	LNG Terminal area	8.0	Class K abandoned road	Not maintained
Source: Study area site visit and discussions with staff from NSTPW				

Allowable Weights and Dimensions

Tractor trailer units on Nova Scotia roadways are generally restricted to the maximum dimensions shown in Table 6.39, depending on how a road has been classified by the NSTPW.

Table 6.39 Allowable Weights and Dimensions				
Road Class	**Allowable Weights and Dimensions**			
	Width (m)	**Height (m)**	**Length (m)**	**Gross Weight (kg)**
Class B	2.6	4.15	23	41,500
Schedule C	2.6	4.15	23	49,500
B-Trail Double Trailer	2.6	4.15	25	62,500
Source: Web site http://www.gov.ns.ca/just/regulations/regs/mvwd.htm (February 2004)				

The section of Industrial Park Road from Trunk 4 to the Statia Terminals wharf access road has been classified for both Schedule C and B-Train Double Trailer units. Bear Head Road from Statia Terminals to the end of the road at the NS Power ash dump entrance is classified for B class loading; however, spring weight restrictions do not apply. Since other roads serving the industrial area have higher allowable weights, a request can be made to NSTPW to change the road classification. Weights and dimensions in excess of allowable limits are often permitted by requesting a Special Move Permit.

Collision Data

During the five year period from 1998 to 2002, there were 19 recorded collisions at the signalized Trunk 4 / Industrial Park Road intersection (Table 6.40). There were nine property damage only and ten personal injury collisions. Collisions at the intersection generally involve rear end collisions or left turning vehicles that fail to yield right-of-way, which is typical of many signalized intersections. There was only one reported collision on Industrial Park Road during the five year period involving a right angle property damage collision at the Stora Enso Pulp Yard entrance.

Table 6.40 Collision History at Reeves Street Intersection 1998 to 2002

Year	Number of Collisions by Severity			
	PDO	Injury	Fatal	Total
1998	0	2	0	2
1999	4	1	0	5
2000	1	3	0	4
2001	1	2	0	3
2002	3	2	0	5
TOTALS	9	10	0	19

Source: NSTPW collision data base

The Trunk 4 / Industrial Park Road intersection was reconstructed during the fall of 2003 and an advance left turn signal phase was included. It is expected that these changes will improve intersection levels of performance and safety. One reported collision on Industrial Park Road over a five year period is not considered an indication of any significant safety problem.

6.2.7 Economic Development

This section describes the local and regional economy of the study area that could be affected by Project development including employment and income and businesses. The Project site is located in Richmond County in very close proximity to the Town of Port Hawkesbury (located in Inverness County).

6.2.7.1 Employment and Income

For the Town of Port Hawkesbury, the median total income of persons 15 years of age and over was $19,800 in 2001, of which 72.2% came from earnings, 13% from government transfers, and 14.9% from other sources of income (Statistics Canada 2001a). Among the labour force in Port Hawkesbury, the average annual earnings for full-time employment was $40,002, higher than the provincial average of $37,872 (Statistics Canada 2001a).

For Richmond County, the median income of persons 15 years of age and over was $14,292 in 2001, of which 62.9% came from earnings, 27.3% from government transfers, and 9.8% from other sources of income (Statistics Canada 2001b). The average annual earnings for full-time employment was $35,807, lower than the provincial average (Statistics Canada 2001b).

6.2.7.2 Business

The Town of Port Hawkesbury is located in Inverness County where primary employers are in the fishing and tourism industry (Strait-Highlands Regional Development Agency 2003). There are also various sized employers involved in the harvesting of forest resources. In 1996, the major employers in Inverness County included: Atlantic Superstore in Port Hawkesbury; Bayview Education Centre in Port Hood; CB Highlands Acadian Education Centre in Terre Noire; Cheticamp Packers in Cheticamp; Inverness Consolidated Memorial Hospital in Inverness; Nova Scotia Community College-Strait Area Campus in Port Hawkesbury; Sobeys Inc. in Port Hawkesbury; Strait Regional School Board in Port Hastings; Tamarac Education Centre in Port Hawkesbury; and Wal-Mart in Port Hawkesbury (Nova Scotia Department of Finance 2002a).

The overall labour force in Inverness County is employed in various sectors ranging from the provision of services to the exploitation of natural resources. In 1996, the division of labour force by employment sector included: health, social services, education services, government services (20.1%); retail (12.3%); accommodation (10.4%); manufacturing (10.1%); construction (6.3%); fishing (5.9%); transportation (4.4%); and logging and forestry (3.5%) (Strait-Highlands Regional Development Agency, 2003).

In neighbouring Richmond County, the major employers include government service providers, natural resource industries and food production. In 1996, the major employers for the Richmond region included: Clearwater Limited Partnership in Arichat; the Municipality of the County of Richmond in Arichat; Richmond Academy in Louisdale; Richmond Villa in St. Peter's; Stora Enso in Point Tupper; and the Strait Richmond Hospital in Cleveland (Nova Scotia Department of Finance (NSDF) 2002b). The Richmond County labour force is employed in a number of sectors which include: services (which encompasses retail services) (36%); trade (13%); manufacturing (12%); construction (4%); transportation; communication and utilities (8%); and public administration (6%) (NSDF 2002b).

A representative list of large employers in the Strait of Canso Region where Port Hawkesbury is located is provided in Table 6.41. These include companies such as manufacturing (*e.g.*, East Coast Hydraulics) to recreational boat building operations (*e.g.*, Superport Marine Services Ltd.) (Strait-Highlands Regional Development Agency 2002).

Table 6.41 Large Employers in the Strait of Canso Region		
Company	**Type**	**Number of Employees**
EDS Canada Inc.	Customer Interaction Centre	300 +
East Coast Hydraulics & Machinery	Light Industrial Fabrication	20
Georgia-Pacific Canada Inc.	Mining	110
Martin Marietta Materials Canada Ltd.	Aggregates	90
Mulgrave Machine Works	Manufacturing/Fabrication	40
Nova Scotia Power Inc. Point Tupper Generating Station	Power Generating Station	75
Ocean Nutrition Canada Inc.	Biomedics/Manufacturing	135
ExxonMobil Canada Properties	Natural Gas Processing Plant (Goldboro) and Fractionation Plant (Point Tupper)	68
Statia Terminals Canada Partnership	Trans-shipment Terminal of Oil and Gas	80
Stora Enso Port Hawkesbury Ltd.	Paper Manufacturing	800 direct 600 contractor employees
Superport Marine Services Ltd.	Recreational and Commercial Boat Building	30
Source: Strait-Highlands Regional Development Agency, 2002		